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UNITED STATES COAST PILOT

ALASKA

PART II

YAKUTAT BAY TO ARCTIC OCEAN

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Serial No. 34

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
E. LESTER JONES, SUPERINTENDENT

UNITED STATES COAST PILOT

ALASKA

PART II

YAKUTAT BAY TO ARCTIC OCEAN

FIRST EDITION

PRICE, 50 CENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

VK 74.3
U62

GIFT

UNIV. OF
CALIFORNIA

DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, D. C., February 29, 1916.

This publication covers the coast of Alaska from Yakutat Bay t the Arctic Ocean, including the Aleutian Islands.

In the surveyed areas it is based upon the work of the Unitec States Coast and Geodetic Survey, while in the unsurveyed areas it is a compilation of information gathered from a wide variety of sources.

The material was gathered by the coast pilot section, assisted by various field officers, and the final compilation made by R. S. Patton, chief, coast pilot section, and A. L. Giacomini, nautical expert, under the direction of Herbert C. Graves, chief of the division of hydrography and topography, Coast and Geodetic Survey.

Navigators are requested to notify the Superintendent of the Coast and Geodetic Survey of any errors or omissions they may find in this publication, or of additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES,
Superintendent.

335671

UNIV. OF CALIFORNIA

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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles*, and may be converted approximately to statute miles by adding 15 per cent to the distances given.

Currents are expressed in knots, which are nautical miles per hour.

Except where otherwise stated, all depths are at *mean lower low water*.

Supplements and other corrections for this volume are issued from time to time, and will be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

UNITED STATES COAST PILOT.

ALASKA—PART II—YAKUTAT BAY TO ARCTIC OCEAN.

NAVIGATIONAL AIDS AND THE USE OF CHARTS.

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, a catalogue of these publications, and Notice to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

Charts bear three dates which should be understood by persons using them—(1) the date (month and year) of the edition, printed on the late charts below the border in a central position and on the older ones on the face of the chart; (2) the date of the latest correction to the chart plate, printed in the lower left-hand corner below the border; (3) *the date of issue, stamped* below the border and just to the left of the subtitle.

Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. All small but important corrections occurring subsequent to the date of issue of the chart are published in Notices to Mariners, and should be applied by hand to the chart immediately after the receipt of the notices.

The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition.

When a correction, not of sufficient importance to require a new edition, is made to a chart plate, the year, month, and day are noted in the lower left-hand corner.

All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted.

The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately $\frac{1}{1{,}200{,}000}$ which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea.

2. General charts of the coast, on scales of $\frac{1}{400,000}$ and $\frac{1}{200,000}$ intended especially for coastwise navigation.

3. Coast charts, on a scale of $\frac{1}{80,000}$, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.

4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

COAST PILOTS, relating to the surveyed waters of the United States, Porto Rico, and a part of Alaska, and Sailing Directions of the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. Similar information relating to parts of Alaska and Hawaii is published in Coast Pilot Notes.

Coast Pilots are corrected for important information received to the date of issue, which is stamped on the correction sheets accompanying the volume. From time to time, as the material accumulates, supplements are issued, containing the more important corrections since the publication of the volume. The supplements are printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

TIDE TABLES.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made, and contain the predicted time and height of the tides for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given by means of which the tides at more than 3,000 intermediate ports may be obtained. Separate reprints from the general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

AGENCIES for the sale of the Charts, Coast Pilots, and Tide Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the suboffices of the Survey. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the Survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey Office, Washington, D. C.

OTHER PUBLICATIONS.—Lists of Lights, Buoys, and other Daymarks of the United States, its insular possessions, and the Great Lakes, are published by the Bureau of Lighthouses. Notice to Mariners, relating to the same waters, are published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. These publications can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS.

ACCURACY OF CHART.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide.

This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and part of Bering Sea and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed it may be taken for granted that the survey was not in great detail.

A wide berth should therefore be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made.

Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary.

The actual depth of a completed channel may be greater than the charted depth shortly after dredging, and less when shoaling occurs as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore when a vessel's draft approximates the charted depth of a dredged channel, the latest information should be obtained before entering.

DANGER CURVES.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart, and regard this as a "danger curve," which is not to be crossed without precaution.

Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

CAUTION IN USING SMALL-SCALE CHARTS.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale, therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason, bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

DISTORTION OF PRINTED CHARTS.—The paper on which charts are printed has to be dampened. On drying, distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

BUOYS.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions; it is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

GAS BUOYS and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished, or, if intermittent, the apparatus may get out of order.

LIGHTS.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet for the observer's eye. The table of distances of visibility due to height, published in the Light List, affords a means of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking for a light, the fact may be forgotten that from aloft the range of vision is increased. By noting a star immediately over the light a bearing may be afterwards obtained from the standard compass.

The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility

in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

FOG SIGNALS.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind, it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time; mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it.

Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

SUBMARINE BELLS have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

TIDES.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with flood or ebb tide. In some localities the rise or fall may be at a stand while the current is at its maximum velocity.

THE TIDE TABLES published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

PLANE OF REFERENCE FOR SOUNDINGS ON CHARTS.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the two exceptions noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Puget Sound, Wash., the plane of reference is 2 feet below mean lower low water and for Wrangell Strait, Alaska, it is 3 feet below mean lower low water.

For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs.

For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water there will generally be as many low waters or lower low waters below those planes as above them. Also the wind may at times cause the water to fall below the plane of reference.

TIDAL CURRENTS.—In navigating coasts where the tidal range is considerable special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore.

The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence.

A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels.

Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

Where there is a large tidal basin with a narrow entrance, the strength of the current in the entrance may occur near the time of high and low water, and slack water at about half tide, outside.

The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve.

Counter currents and eddies may occur near the shores of straits, especially in bights and near points.

TIDE RIPS AND SWIRLS occur in places where strong currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current; when these conditions are at their worst the water is broken into heavy choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the bearing of the propeller and rudder.

CURRENT ARROWS on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current will not vary from that indicated by the arrow. In the same manner, the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

FIXING POSITION.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with

a protractor sextant angles between well-defined objects on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters, also, where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

For its successful employment it is necessary: First, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand, distant objects should be used for direction because less affected by a small error or change of position.

The three-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a revolver, must be avoided. In case of doubt select from the chart three objects nearly in a straight line, or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly

may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range give in general an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors.

When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers so that the distance measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

DANGER ANGLE.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

SOUNDINGS.—In thick weather, when near, or approaching the land or danger, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method should be well

understood, and this method should be in constant use. The Sumne line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

Change of Variation of the Compass.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are reengraved for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

Local Magnetic Disturbance.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and the force strong the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together.

The law which has hitherto been found to hold good as regards local magnetic disturbances is that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled.

It is very desirable that whenever an area of local magnetic disturbance is noted the position should be fixed and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves—i. e., waves in deep water—the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, either when running or lying-to or in wearing.

6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.

7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the character of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls.

The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow—e. g., from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow and another position farther aft seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling, if necessary.

COAST WATERS, YAKUTAT BAY TO ARCTIC OCEAN.

GENERAL INFORMATION.

The information contained in this volume relates to the coast waters from Yakutat Bay to the Arctic Ocean, including the various groups of islands along the south side of the Alaska Peninsula, the Aleutian Islands, Prince William Sound, Cook Inlet, Bristol Bay, and the various other indentations.

Westward to Cook Inlet the characteristic formation is rocky; the waters in general are deep, but there are also great variations in depth. The visible topographic features, characterized by mountainous areas, numerous rugged islands, rocks and reefs, are undoubtedly duplicated beneath the surface of the water. A safe rule to follow in the navigation of these waters is to avoid all areas where the chart shows great irregularities in depth.

In Cook Inlet the characteristic formation is the result of glacial action. At low water the shores will be seen strewn with bowlders, some of them of great size, and the soundings indicate that these bowlders also occur in the deeper waters, particularly in areas of hard bottom, where they have not been buried by the subsequent deposit of silt.

Westward from Cook Inlet, along the south side of the peninsula, throughout the offlying islands, and throughout the entire extent of the Aleutian Islands, the rocky formation above described is again found.

Bering Sea is characterized in general by shoal waters, with extensive sand or mud flats along the shores, particularly in the approaches to the various bays and rivers. There is little rocky formation, and its occurrence, where found, is limited in area.

Weather.—The weather in general is misty or rainy, with fog and frequent blows. It will usually be found that an on-shore wind brings misty weather, and an offshore wind, clearing weather. It will also be found that the weather noticeably improves as one proceeds toward the head of the various inlets. Thus, at the head of Prince William Sound, Cook Inlet, Nushagak Bay, or Kuskokwim Bay, bright clear weather will occur when there is wind and rain at the entrances. The weather is discussed in greater detail under the heading of the various localities.

Harbors and ports.—From Yakutat Bay to Cape St. Elias the coast is open and unbroken, affording no shelter. From this point westward to the end of the Aleutian Islands, there are numerous good harbors where vessels may find shelter from any weather. In Bering Sea, northward and eastward of Unimak Pass, the harbors are few and are characterized by shoals in the approaches, so that in the absence of detailed surveys local knowledge is necessary to enter.

The principal ports are Cordova and Valdez in Prince William Sound, Seward in Resurrection Bay, Anchorage at the head of Cook

Inlet, Kodiak on Kodiak Island, and St. Michael in Bering Sea. At each of these places there are blacksmith and machine shops where repairs to machinery may be made, and carpenters available for woodwork above water. Similar facilities are available at Nome, but the anchorage is in an open roadstead.

There are no dry docks or marine railways, but the great range of tide makes it an easy matter to choose a spot at low water for beaching a vessel at high water where she will be high and dry at low tide.

At any of the canneries there are facilities for making minor repairs to machinery.

Ice will seldom be encountered south of Unimak Pass. It occurs locally where discharged from glaciers, and in winter is formed at the head of the various inlets, but never gets far from its source. Its occurrence, and also the ice in Bering Sea, are discussed in detail under the headings of the various localities.

Kelp grows on nearly every danger having a rocky bottom, and will be seen on the surface of the water during the summer and autumn months; during the winter and spring it is not always to be seen, especially where it is exposed to a heavy sea. Kelp should always be considered a sign of danger, and no vessel should pass through it unless the spot has been carefully sounded. There are, however, many rocks not marked by it; a heavy sea will occasionally tear the kelp away from rocks, and a moderate current will ride it under water so that it will not be seen. It is well to note that dead, detached kelp floats on the water in masses, while live kelp attached to rocks streams away level with the surface.

Pilotage is not compulsory for Alaska except as provided in the United States laws governing the Steamboat-Inspection Service. Vessels making canneries, mines, and other settlements in unsurveyed areas can usually obtain the services of some one with local knowledge, although not a licensed pilot.

Supplies.—Vessels usually obtain their supply of provisions and ship-chandler's stores at California, Washington, and British Columbia ports. The principal towns and settlements in western Alaska can furnish provisions and a limited supply of ship-chandler's stores. Nearly all the canneries and mining settlements carry a limited supply of provisions for sale. (For supplies see also the different headings.)

Fuel oil is usually obtained from the larger vessels which use it as fuel. Coal can be obtained at Cordova, Kodiak, and Unalaska. It may at times be obtained at other places, but such supply should not be counted on without previous arrangement.

Naval radio stations are operated at Cordova (Point Whitshed), Kodiak, Unalaska, and St. Paul Island. There is a station at Nome maintained by the United States Army, and many of the canneries are equipped with radio outfits which are in operation during the season.

TIDES.

Along the outer coast of Alaska between Yakutat Bay and the western end of Alaska Peninsula the tide is nearly simultaneous, high water occurring near the time of the transit of the moon. Between Yakutat Bay and Cape Whitshed mean high water rises from 9 to 10 feet above the plane of reference. Extreme variations

from 4 feet below to 15 feet above the datum may occasionally be expected.

Throughout **Prince William Sound** the tide is practically the same in regard both to time and to height. High water occurs near the time of the transit of the moon, and the mean height of high water is about 11 feet above the plane of reference. Extreme variations from 4 feet below to 16 feet above the datum may sometimes occur.

In **Resurrection Bay** the rise of tide is about 1 foot less than in Prince William Sound.

In passing up **Cook Inlet** the time and height of the tide changes very rapidly. At Fire Island the tide is about five hours later than at Port Chatham. At Anchorage in Knik Arm it is about one-half hour later, and at Sunrise in Turnagain Arm about one hour later than at Fire Island. The height of mean high water above the plane of reference varies from about 13 feet in the vicinity of Port Chatham to 30 feet in Knik Arm and 33 feet in the eastern part of Turnagain Arm. Variations from 6 feet below the plane of reference to 6 feet above mean high water may occasionally occur. The mean range of tide on the west side of Cook Inlet is less than it is on the east coast, the difference being as great as 3 feet at the widest part of the inlet.

On the eastern side of **Kodiak Island** the height of mean high water is about 9 feet above the plane of reference, but in Shelikof Strait the mean high water rises from 13 to 14 feet above the datum. Extreme variations from 4 feet below to 14 feet above the datum on the eastern side and from 4 feet below to 18 feet above the datum on the western side of the island will occasionally occur. In Shelikof Strait the tide will occur about 15 minutes later than on the eastern side of the island.

From **Kodiak Island to the westward** the range of tide diminishes rapidly. In the vicinity of the Shumagin and Sannak Islands the mean high water is approximately 6 feet above the plane of reference. There is, however, very little difference in the time of the tide until the western end of the Alaska Peninsula is reached.

Around the **Aleutian Islands** the tide is very irregular and at times becomes diurnal. The mean high-water interval varies from zero to four hours, and the mean rise of tide from 2 to 6 feet above the datum.

At the **Pribilof Islands**, St. Matthew Island, and St. Lawrence Island, in the Bering Sea, the tide is small and irregular, the mean rise being less than 4 feet above the datum.

In **Bristol Bay** the range of tide increases very rapidly in passing toward the head of the bay. At Port Moller the mean rise is 9½ feet above the datum, and at Clark Point, Nushagak Bay, it is 18 feet. At the latter place the tide occurs approximately five hours later than at Port Moller.

In **Kuskokwim Bay** the height of mean high water above the plane of reference increases from 7 feet at Goodnews Bay entrance to 10½ feet off Warehouse Creek and then diminishes to 2½ feet at Bethel. At Apokak the tide occurs nearly five hours later than at Goodnews Bay entrance, and at Bethel it is about five and one-half hours later than at Apokak. The range of tide is greater on the east side than it is on the west side of the bay, the difference being about 1 foot in the vicinity of Apokak.

In **Norton Sound** the tide is generally small and irregular and during a large part of the time diurnal. The mean rise and fall is about 3 feet.

In the vicinity of **Bering Strait** the tide is too small to be of practical importance.

Along the **Bering Sea** coast of Alaska extreme tides, varying from 3 feet below the plane of reference to 6 feet above mean high water, may occur occasionally.

For more detailed information concerning the tides in Alaska, the General or Pacific Coast Tide Tables for the current year should be consulted. These are published annually in advance by the United States Coast and Geodetic Survey, and may be obtained from the office or from any of the agencies of this Bureau on receipt of the price, which is 50 cents for the general tables and 10 cents for the Pacific Coast reprint.

CURRENTS.

A prevailing current sets northward and westward along the coast of British Columbia and Alaska. The distance it extends offshore is not known, but it is believed to be strongest near the coast and inside of the 100-fathom curve.

The estimated velocity of the current is 0 to 1½ knots, and is greatly affected by strong winds. In winter, with strong northerly and westerly winds prevailing in the Gulf of Alaska, it is probable that the current is stopped, and there may be a set in the reverse direction. No systematic observations have been made, but the following sample reports indicate what may be expected:

Capt. J. A. O'Brien, of the steamer *Northwestern*, reports that from February to May, 1911, during six round trips between Cape Flattery and Cape St. Elias his log showed an average of 977 miles northbound and 1,104 miles southbound, an average current of 63.5 miles for the run of about 1,040 miles. On each of the six voyages he found a strong set toward the coast between Cape Cook, Vancouver Island, and Cape St. James, Queen Charlotte Islands, and between the northwest end of Queen Charlotte Islands and Sitka. Between Cape Flattery and Cape Cook an average of over 40 voyages indicated a northwesterly current with a velocity of 1.5 knots in winter and about nil in summer.

On May 1, 1910, on a run from Ocean Cape to Cape St. Elias with light easterly winds, a vessel with a speed of 8.1 miles by log was set in 13.5 hours about 28.5 miles in a 291° true (W ¾ S mag.) direction by the coast current, the average velocity of which was 2.1 knots. Land was made on the eastern side of Kayak Island 7 miles northward of the projected course. This report shows the necessity for using caution in approaching Cape St. Elias from southeastward, as the prevailing northwesterly current will cause the vessel to be ahead of her reckoning.

Surveying parties report a constant set southwestward along the coast of Hinchinbrook Island.

A constant set southwestward is reported along the east coast of Montague Island and south coast of Kenai Peninsula. A whaleboat lost off Wooded Islands was washed ashore on Cape Douglas and a spar lost off Point Gore was found on the northwest side of Sitkinak

Island. The velocity is not known, but has been reported to be 1 knot or more at times.

Currents of the Alaska Peninsula Westward of Kodiak.—It seems clear from all reports that the Japan current does not touch the shores of the Alaska Peninsula; and there is doubt if it touches even the southernmost of the Aleutian Islands. It is even disputed that this current is found at all this far eastward; no such warm water can be found as that of the Gulf Stream, but a fairly definite stream of slightly warmer water can generally be found. This stream is well offshore and far out of sight of land; the current phenomena met with in the vicinity of the coast have no connection with it.

It is generally agreed that there is a continual current of considerable strength following the coast all the way from Shelikof Strait to Unalaska Island. It has been called a warm current originating in the Gulf of Alaska, and it doubtless assists in causing the southern side of the peninsula to be warmer than Bering Sea. It is well known that all the islands off this coast have a milder climate than the mainland; the inhabitants choose the islands and almost the entire population is found on them in preference to the mainland shore. This current searches out all the passages, large and small, between and around the many islands, and in some of them it becomes strong enough to be important. The tide has little effect upon it, for the tide sets generally on and offshore, while this current sets along the coast. For this reason a vessel generally finds it setting her ahead or back along the course and not to one side. An approaching northeast storm gives warning by strengthening this current; in many places the current will indicate northeast weather a day before the barometer falls. It may be that on some occasions this current turns in the other direction on its offshore side, near the 100-fathom curve, but this is not frequent, and there are no reports that it turns in the inshore part near the land. It has been supposed that the strong currents of Unimak, Akutan, and Unalga Passes are due to this current deflected into the passes and strengthened by a rising tide. It is reported by all that the strongest currents are found entering Bering Sea in these passes and that the currents flowing out are always weaker.

In the Aleutian Island passages, as far as Attu, reports agree that the currents almost always flow into Bering Sea. There are many reports of strong currents in all the passages in this direction, and almost none in the opposite direction. These currents are not to be regarded as branches of the Japan stream, for the water temperatures do not show a warm current; but it is agreed that they carry much small animal and plant life to the shores of the islands and into Bering Sea. Southward of the Aleutian Islands there is often a current toward them and toward all the passes; but farther offshore, well out of sight of land, the Japan stream is found setting eastward.

Along the northern side of the islands, on a line from Unalaska to Attu, it is agreed that the current sets eastward, and is not influenced by tide. But in all this region and in Bering Sea the normal currents may be disturbed by bad weather, and will then set with the wind or toward a low barometer; an abnormal current may often be a valuable storm warning. In all the Aleutian Islands the navigator must heed the currents carefully; a vessel is in more danger there from that cause than from any other, except the lack of surveys.

The currents of Bristol Bay are usually considered as partly tidal. Here, also, a northeast storm disguises all other effects and causes a strong current to sweep out of the bay. In normal weather the tidal currents set on and offshore and more or less in and out of the bay, and become more important as the water shoals; the local effects in places are pronounced. Beside the tidal currents, it is considered that Bristol Bay forms the eastern side of a permanent eddy which enters past Cape Newenham flowing eastward and discharges along the north shore of Unimak Island flowing westward. On the Bering Sea side of Unimak Pass it is generally found that there is a current flowing northwest.

DIRECTIONS, YAKUTAT BAY TO KODIAK.

From Cape St. Elias to the head of Cook Inlet and southward to Chiniak Bay, Cape Karluk, and Takli Island, and from Cape Ikti to Unalaska, the principal points along the coast are determined by triangulation, and accurate courses and distances for coasting along those sections can be taken from charts 8502 and 8802 (1915 edition). Some of the bays and arms are not surveyed, and their delineation on the chart is taken from the sketches of the early navigators adjusted to known points determined by later surveys.

Vessels approaching Prince William Sound from southeastward generally make Cape St. Elias and pass 2 miles or more southward of Southeast Rock. On page 30 bearings and distances are given from Southeast Rock to the principal coast points of Southeast Alaska. A current, constant so far as known, sets northwestward and westward along the coast of Alaska. This current is increased by southeast winds and decreased by northwest winds, but its estimated velocity under ordinary conditions is about ¾ knot. This should be kept in mind, especially when approaching Cape St. Elias from southeastward, as a vessel will generally overrun her log when bound westward. (See also the remarks on currents preceding.)

Cape St. Elias to Cape Hinchinbrook.—From a position 2 miles southward of Southeast Rock a 295° true (W ¼ S mag.) course made good for 67 miles will lead to a position 1½ miles southward of Cape Hinchinbrook.

An examination of the logs of several courses between Cape St. Elias and Cape Hinchinbrook indicates that the currents are influenced by the tides, being stronger with the larger tides, and that the current on the ebb has frequently, but not always, caused a southerly set, and the current on the flood a northerly set. On some occasions when the range of the tides was small no marked set of current was noted. Results seem to point to a stronger current toward Cape St. Elias than Cape Hinchinbrook. Surveying parties report a constant set southwestward along the coast of Hinchinbrook Island, and the probability of a constant westerly set from Cape St. Elias to Cape Hinchinbrook should be kept in mind. Strong tidal currents were noticed across the reef at Cape St. Elias. At Middleton Island the tidal currents have a velocity of 2 to 3 knots, setting northward on the flood and southward on the ebb.

Prince William Sound.—Vessels from southeastward enter Prince William Sound through Hinchinbrook Entrance, and leave the

sound through Elrington Passage when bound southwestward. The principal ports of call are Cordova and Valdez. Directions for Orca Bay to Cordova are given on page 43. Directions for the sound from Hinchinbrook Entrance and Latouche Passage to Valdez are given on page 50. Directions for Elrington Passage are given on page 68.

Elrington Passage to Resurrection Bay.—Having come from Elrington Passage to a position 3 miles 168° true (SE ½ S mag.) from Cape Puget, steer 263° true (SW by W mag.) for 26 miles, passing 2 miles off Cape Junken. The south end of Rugged Island should be ahead, and the course and distance made good should lead to a position 1 mile 173° true (SE by S mag.) from Barwell Island off Cape Resurrection. Then follow the directions for entering Resurrection Bay from eastward.

Elrington Passage to Seal Rocks.—Having come from Elrington Passage to a position 3 miles 168° true (SE ½ S mag.) from Cape Puget, a 235° true (SSW ½ W mag.) course made good for 43 miles will lead to a position 3 miles 150° true (SE by E mag.) from Seal Rocks.

There is little information about the currents between Cape Cleare and Seal Rocks. When out of the bight of the coast between these points a southwesterly set may be experienced. The principal flood and ebb current to and from Prince William Sound westward of Montague Island is through Montague Strait.

The **passage between Seal Rocks and Chiswell Islands** is nearly 3 miles wide and is frequently used by vessels between Resurrection Bay and the coast southwestward. In thick weather or at night, and also when vessels are standing along the coast and not entering Resurrection Bay, it is better to pass outside of Seal Rocks.

Seal Rocks to East Chugach Island.—From a position 3 miles 150° true (SE by E mag.) from Seal Rocks, make good a 245° true (SW ½ S mag.) course for 26 miles to a position 3½ miles 155° true (SE ½ E mag.) from the peak of the outer Pye Island; Pye Island Reef should then bear 296° true (W mag.) distant 2½ miles. Or vessels from Resurrection Bay going inside Seal Rocks, pass 1½ to 2 miles southeastward of the easterly Chiswell Island and make good a 236° true (SSW ⅝ W mag.) course for 30 miles, passing 1 to 1½ miles northwestward of Seal Rocks and to a position 3½ miles 155° true (SE ½ E mag.) from the peak of the outer Pye Island.

From a position 3½ miles 155° true (SE ½ E mag.) from the peak of the outer Pye Island, make good a 246° true (SW ⅜ S mag.) course for 35½ miles, passing 2 miles off Point Gore, 1¾ miles off the sunken rock nearly midway between Point Gore and East Chugach Island, and to a position with the southeast point of East Chugach Island bearing on the starboard beam, 336° true (NW ⅜ W mag.) distant 3 miles.

Under ordinary conditions the current may be expected to set southwestward along the coast, but its rate is not known. It is reported that the flood current sets strongly southwestward toward Cook Inlet, while the ebb current is almost negligible. When crossing the entrances to the larger bays, the tidal current setting to or from them will be noticed.

In 1908 a breaker in a heavy sea was reported about 9 miles 177° true (SSE ½ E mag.) from the southeast point of East Chugach Island.

East Chugach Island to entrance of Cook Inlet.—The following is the usual route followed by large vessels. The smaller vessels, especially with local knowledge, frequently go through the passage inside Pearl and Elizabeth Islands. Directions for this passage are given on page 78.

From a position 3 miles 156° true (SE ⅜ E mag.) from the southeast point of East Chugach Island, make good a 269° true (SW by W ¾ W mag.) course for 15 miles, passing 2 miles off the southeast bare rock near Pearl Island, the same distance southward of Dora Reef, and to a position with Cape Elizabeth bearing on the starboard beam 359° true (NNW ¼ W mag.), distant 5½ miles. Then follow the directions for Cook Inlet.

The **tidal currents** in the entrance of Cook Inlet have great velocity, especially among and around Chugach and Barren Islands and off the north end of Shuyak Island. With the large tides, rips dangerous to small craft occur in the channels among the islands and in the wake of many projecting points. With an ebb current of the large tides and easterly winds, a very heavy sea and tide rips will be found in mid-channel on either side of Barren Islands.

From Pearl Island nearly to Seldovia and southward in the entrance of Cook Inlet the tidal currents have an estimated velocity of 3 to 5 knots at strength, and care will be required to make courses good.

Cook Inlet to Kodiak.—The usual route is through Marmot Strait. With heavy easterly weather vessels sometimes go down Shelikof Strait and pass eastward through Kupreanof Strait.

From a position 1½ miles westward of Flat Island steer 185° true (S by E ¾ E mag.) for 24 miles to a midchannel position between the northeast end of Ushagat Island and the southwest end of West Amatuli Island.

Then steer 170° true (SE by S mag.) for 36 miles to a position 1¼ miles off a point 1½ miles southeastward of Tonki Cape. Then steer 180° true (SSE ⅛ E mag.) for about 4½ miles to a position about 1¼ miles off a prominent point on the western shore; the northern end of Marmot Island should then bear about 80° true (NE by E mag.).

Then steer 203° true (S ⅛ E mag.) giving the western shore of Marmot Strait a berth of about 1 mile; the distance to Pillar Cape abeam is 8½ miles. Continue the course across Marmot Bay, passing 3 miles eastward of Spruce Island and the same distance westward of Williams Reef. The eastern end of Woody Island should be made ahead, and the course made good for 28 miles, or 19½ miles from Pillar Cape abeam, will lead to a position ½ mile eastward of Hutchinson Reef bell buoy. Then enter St. Paul Harbor on one of the ranges for the northern entrance.

See **tidal currents** in the entrance of Cook Inlet above. In Marmot Strait the tidal currents have an estimated velocity of 1 to 3 knots, the flood current setting northward and the ebb southward.

YAKUTAT BAY TO CAPE ST. ELIAS.

Point Manby is low and wooded for about 4 miles back to Malaspina Glacier.

Sitkagi Bluffs are about 4 miles long, and are formed by Malaspina Glacier, which at the bluffs comes down to high-water mark, but does not discharge into the sea. From Sitkagi Bluffs the glacier recedes from the coast about 4 miles up the Yahtse and Yana Rivers, and then comes to the coast again at Icy Cape.

Icy Bay has been formed by the recession of an arm of Malaspina Glacier, which discharges in the bay; there are large quantities of drift ice, at least during the summer. Depths of 6 to 8 fathoms extend in places about 5 miles off the entrance. The entrance points are low spits, and the depths between them and in the bay are not known. The west side of Icy Bay appears to be shallow for a distance of at least ½ mile from shore, judging by the stranding of comparatively small bergs. Smaller ice masses are generally so packed along the shores that boats would find it difficult to make a landing, especially as the ice grinds together when moved by the ocean swell which enters the bay.

From Icy Bay to Cape Suckling the beach is remarkably even, with no irregularities except Umbrella Reef and Yakataga Reef. There are numerous small streams, the larger ones with lagoons and shallow bars at the entrance. The streams are dangerous to cross because of quicksand in places in their shifting channels. The coast is low and wooded and backed by ice fields and glaciers.

Umbrella Reef, 13 miles east of Yakataga Reef, is a narrow ledge ⅛ mile wide and ¾ mile long parallel with the shore. Little of it shows above high water.

Yakataga Reef extends about ½ mile from shore at Cape Yakataga, and parts of it show above high water. This is the best landing place between Icy Bay and Controller Bay, but landing is possible only under exceptional conditions of a smooth sea. There are a few houses.

Mount St. Elias is 18,025 feet high, and at the top is a massive pyramid with a shoulder on each side as seen from southward.

Cape Suckling is low and wooded. Lying 2 miles northwestward of the cape and 1 mile inland is the end of a prominent mountain ridge which extends about 8 miles in a northeasterly direction, with elevations of 1,500 to 2,500 feet.

Three bluffs about 100 feet high lie 1½ to 2⅞ miles westward of Cape Suckling. From the eastern bluff a sunken reef extends ⅝ mile southwestward to three rocks, close together and bare at low water.

Southwest Breaker is on a rock bare at low water, and lies 2 miles 212° true (S ¼ W mag.) from the western bluff mentioned in the preceding paragraph, and 3¾ miles 260° true (SW ½ W mag.) from Cape Suckling.

Okalee Spit, forming the south side of Controller Bay, is low, bare sand dunes, 7 miles long in an east and west (true) direction.

The **entrance to Controller Bay** between the north end of Kayak Island and Okalee Spit is of little use except for small craft or very small vessels that can cross the flats eastward of Wingham Island.

Two prominent rocks about 75 feet high lie outside the entrance, 1½ miles northeastward of Lemesurier Point and 1¼ miles southward of Okalee Spit. They are connected by ledges bare at low water, which also extend about 300 yards eastward and westward from them. The group is prolonged by shoals, which shelve off to 18 feet in a distance of ⅞ mile 299° true (W mag.) from the western rock and to 16 feet a little over ½ mile 82° true (NE ¾ E mag.) from the eastern rock.

From the shoal surrounding the rocks a rocky bar with 17 to 19 feet over it extends 1¼ miles eastward on the range of the two rocks, and then with 19 to 21 feet over it curves northeastward and joins the shoal with 16 to 18 feet over it that extends about 1¼ miles from Okalee Spit. This bar is open to the sea from eastward and southward. The channel to this entrance of Controller Bay is over this bar with a least depth of 17 to 19 feet and then passes between Okalee Spit and the two rocks.

From **Lemesurier Point** (northeast end of Kayak Island) foul ground with 13 feet over its outer half extends nearly to the shoal surrounding the two high rocks. There is little depth near Lemesurier Point, and it shelves off to 10 feet in a distance of ½ mile toward the two rocks.

From northward of the two high rocks the channel has depths of 5 to 7 fathoms until about 1 mile inside the north end of Kayak Island. It then leads between flats to Kayak Entrance with a least width of ¼ mile and depth of 18 feet. The best depth that can be carried across the flats in Controller Bay eastward of Wingham Island is 6 feet at low water.

Kayak Island is 17½ miles long, has peaks 1,200 to 1,400 feet high, and slopes gradually to its northern part, which is low and wooded. **Cape St. Elias**, the south end of Kayak Island, is an important and unmistakable landmark. It is a precipitous, sharp, rocky ridge, about 1 mile long and 1,665 feet high, with a low, wooded neck between it and the high parts of the island farther north. About ¼ mile off the cape is the remarkable **Pinnacle Rock**, 494 feet high. A light is maintained on Pinnacle Rock pending the completion of a lighthouse on the cape.

Boats can generally land on the south side of Cape St. Elias just eastward of a small point which extends toward Pinnacle Rock. The better approach is from westward, keeping close to the island to clear a ledge which extends ¼ mile northwestward from Pinnacle Rock.

The eastern coast of Kayak Island is strewn with bowlders and landing is impracticable. Rocky shoals with 11 feet over them lie 1¾ miles 172° true (SE ¾ S mag.) from Lemesurier Point. Lying 3¼ miles southward of the point and 1 mile offshore is a reef ½ mile long. Its northern end is a rock 10 feet high, and its south end is bare at half tide. For a distance of 6 miles northward of Cape St. Elias bowlders bare at low water and breakers extend ¾ mile off the eastern coast of the island.

Breakers extend 2 miles southeastward of Cape St. Elias to **Southeast Rock**, which is awash, the breakers extending ¾ mile southwestward of the line joining them. There is a depth of 20 fathoms about ⅜ mile outside these breakers. A ridge with 10 to 15 fathoms over it, which has not been closely developed, extends 1½ miles southwestward from Southeast Rock. The 50-fathom curve lies about 7 miles

southwestward and westward of Southeast Rock, but is only ½ mile southeastward of it. The tidal currents have considerable velocity across the reef.

Eastward of this reef another reef on which the sea breaks extends 1½ miles from Kayak Island, the end of the reef lying about 1⅝ miles northward from Southeast Rock.

The following are computed bearings and distances from Southeast Rock:

Entrance to Monti Bay, Yakutat, 94½° true (NE by E ¾ E mag.), 145 miles.
Cape Spencer, 111° true (E ¾ N mag.), 263 miles.
Klokachef Point, Salisbury Sound, 117½° true (E ⅛ N Northerly mag.), 307 miles.
Cape Edgecumbe, 121° true (E ⅛ S mag.), 321 miles.
Cape Ommaney, 124° true (E ⅜ S mag.), 383 miles.
Summit of Forrester Island, 130° true (E by S easterly mag.), 467 miles.
Cape Hinchinbrook, 295° true (W ¼ S southerly mag.), 67 miles.

Sea Ranger Reef is two shoals lying off a point on the western coast of Kayak Island 3¼ miles northward of Cape St. Elias. The inner one lies ¾ to 1¼ miles from shore, has 11 feet over it, is ¾ mile long, and the sea often breaks on it. The outer shoal is small, lies 1½ miles from shore, has a least depth of 24 feet, and there is seldom a break on it. Tide rips occur around it at times.

The **tidal currents** on the western side of Kayak Island set northward on the flood and southward on the ebb, with an estimated velocity at strength of ½ to ¾ mile.

From the high bluff point on Kayak Island 3½ miles south of Wingham Island a shoal with 13 feet near its end extends ¾ mile northward; and rocky patches on which the least depths found are 12 to 15 feet extend to Wingham Island. Anchorage can be made by small craft in the bight northward of the point, ¾ to 1½ miles from the point and ½ to 1 mile from shore, in 4 to 5 fathoms, bottom soft in places, with shelter from easterly and southeasterly winds. Vessels should anchor farther out in not less than 10 fathoms, with the southeast end of Wingham Island bearing about 48° true (N by E ¾ E mag.).

CONTROLLER BAY

is formed by Okalee Spit and Kayak Island on the south and Wingham and Kanak Islands on the west. For some distance back from the eastern shore the land is but slightly above high water, and is broken by many streams. Quicksand has been found in the channel at the mouth of Edwardes River. The bay is filled by flats between which are two principal channels, one from Kayak Entrance to the northern end of Kayak Island, and Okalee Channel.

Kayak Entrance, between Kayak and Wingham Islands, is rocky and foul, there being numerous lumps on which the least depth found is about 12 feet. The channel with a depth of about 12 feet is ½ mile wide between a sand spit, largely bare at low water, extending 1 mile off the southwest side of the low wooded spit on the northwest side of Kayak Island, and a reef, partly bare at low water, extending 350 yards southeastward from the southeast end of Wingham Island. The approach is lumpy, with numerous rocky spots of 2 to 3 fathoms

inside the 5-fathom curve. The latter is about on a line from the southwest point of Wingham Island to the high bluff point on Kayak Island 3½ miles 201° true (S ¾ E mag.) from it. A reef, partly bare at low water, extends 600 yards southward from the southeast point of Wingham Island.

The following directions lead in the best water through Kayak Entrance, but the entrance should be used with caution and at high water only.

Steer for the end of the low wooded spit on the northwest side of Kayak Island on a 60° true (NNE ¾ E mag.) course until the southeast tangent of Wingham Island bears 6° true (NNW mag.). Then steer 18° true (N by W mag.) and give Wingham Island a berth of 350 yards.

Anchorage can be made about 250 yards northeastward of the point of Wingham Island just southeastward of Kayak, in 3 fathoms, or a short distance southeastward of this position, in depths up to 4 fathoms, bottom soft in places. Good anchorage may also be selected anywhere in the channel from the southeast end of Wingham Island to the northern end of Kayak Island, for which chart 8513 and the lead are the guides. There is some local chop with strong winds, but no outside swell enters the bay either through Kayak Entrance or around the northern end of Kayak Island.

Kayak, on the east side of Wingham Island, ⅜ mile from its southeast end, is abandoned.

Wingham Island is 4 miles long and wooded, and has three hills, the highest, near its northern end, having an elevation of 832 feet. The western shore of the island is precipitous.

With heavy easterly winds anchorage and shelter can be found in 16 to 18 fathoms ⅜ to ½ mile from the western side of Wingham Island, abreast its middle and lowest part.

Small vessels can anchor in the narrow channel close to the eastern side of Wingham Island. This channel is about 300 yards wide and extends nearly 2 miles southward from the northern end of the island, with depths of 7 to 12 fathoms for 1 mile and then shoals gradually southward. The flats on the eastern edge of the channel have depths of 7 to 11 feet and are generally steep-to. The midchannel leads about 200 yards from the island. A depth of 6 feet at low water can be carried through close to the island to Kayak Entrance. At times the tidal currents have a velocity of 3 knots or more in places in the narrow channel eastward of Wingham Island. A shoal extends about 200 yards off the middle of the northern end of the island.

Okalee Channel, between the north end of Wingham Island and Kanak Island, is ⅝ mile wide, with depths of 6 fathoms at the entrance, and these depths or more can be taken through the greater part of the channel. The channel is a secure harbor, but is little used in the absence of aids. The entrance is marked by buoys.

The shoal on the southeast side of the channel 1½ miles northeastward from the northern end of Wingham Island is bare shortly after high water, and this shoal and the one on the opposite side of the channel are generally partly indicated by breakers, especially at low water. The shoal extending southward from Kanak Island is mostly well out at low water. Above these shoals the flats bordering Okalee Channel are partly bare at low water only, and there is

nothing to indicate the channel when the flats are covered. On the edges of the channel the shoaling is abrupt except at the entrance and on the southeast side where it changes direction southeastward of Kanak Island.

Vessels sometimes anchor in Okalee Channel about 2 miles above the northern end of Wingham Island. This part of the channel is generally easy of access in clear weather. Above this point Okalee Channel should be navigated at low water only, in the absence of aids or local knowledge, and extra care is required to keep in the channel. Chart 8513 and the lead are the guides.

Kanak Island is 3¼ miles long, very low and flat, and wooded in the middle. There is a large low tank at the south end of the island. An extensive shoal makes out southwestward from the island, about 3 miles from its southeast end and 2 miles from its northwest end. The southern edge of the shoal passes about 1 mile northwestward from the northern end of Wingham Island. When off the southwest side of Kanak Island, vessels should keep in over 5 fathoms (low water). The range of the north ends of Wingham and Kayak Islands, bearing 119° true (E mag.), leads clear southward of the shoal.

The passage between Kanak Island and Strawberry Point is used only by boats and launches at high water.

Point Hey is a projecting and prominent high, narrow point on the northwest side of Controller Bay 1 mile northward of Kanak Island.

Weather.—During the summer the prevailing winds are easterly with rain, and this is the direction from which the heaviest weather comes. Westerly winds are infrequent during the summer, and generally light. Fog was rare and cleared off before noon.

Tides.—High and low water occur 27 minutes later than at Sitka, and the rise and fall of tides is the same.

The **tidal currents** set into Controller Bay through all the entrances on the flood and out on the ebb. In Kayak Entrance the ebb has greater velocity than the flood, and it is estimated that the greatest velocity at strength does not exceed 3 knots. Tide rips occur at times in the channel abreast the southern end of Wingham Island. The velocity of the current in the channel north of Kayak Island does not exceed 2 knots.

In Okalee Channel, from observations taken, the flood current was found to attain an ordinary maximum velocity of 1.65 knots 1 hour and 45 minutes before the time of high water at Sitka, and the ebb a velocity of 1.95 knots 1 hour and 45 minutes before the time of low water at Sitka. Small tide rips occur when the wind is against the current. The tidal currents have some velocity around the north end of Wingham Island.

KATALLA BAY,

twenty-three miles northward from Cape St. Elias, is included between Strawberry Point on the east and Martin Islands on the west, a distance of 5 miles, and indents the coast about 2 miles to the mouth of Katalla River. The bay is a roadstead anchorage sheltered from offshore winds, but exposed to winds from southeast, south, and southwest.

Strawberry Point is low and bare at the end and wooded toward the foot of the hill. There is a prominent hill on the point with a low

break between it and the higher land northward. A shoal with little water over it, and on which the sea generally breaks at low water, extends nearly 1½ miles southward from the point.

The northeastern shore of the bay from Strawberry Point to the mouth of the Katalla River is a steep sand beach. The northwestern shore from Katalla to Martin Islands is foul and should be given a berth of about ¾ mile.

Palm Point is 1½ miles southwestward of Katalla. There are a number of buildings of a railroad camp just northward of the point. A bowlder reef, bare at low water, extends ⅜ mile southward from it.

Martin Islands are two in number, about 60 feet high, have steep rocky sides, and lie ½ to 1 mile from shore. The northern island is joined to the shore by a flat, bare at extreme low water. There is an abandoned radio station on the northern island.

Katalla is a post office on the northern side of the bay and on the western side of the mouth of Katalla River. There is a landing for lighters, which were towed over the bar except at low water. The bar at the mouth of the river has a depth of about 3 feet at low water, and the sea generally breaks on it. The entrance, which is narrow and rocky, requires local knowledge. With a smooth sea, lighters formerly landed also in the bight on the northeast side of Palm Point. There is always some surf on the beach, and with southeasterly or southwesterly winds landing is impracticable. Goods are discharged by means of a lighter. The necessary towing is done by launches.

On the east branch of Katalla River about 3 miles from Katalla there are oil works which supply local boats with oil, gasolene, and distillate. The depth in the river is ample for boats that can cross the bar.

The boiler of the wreck of the *Portland* can be seen at a good low water. It has not been accurately located, but it is reported to lie in the vicinity of the 5-fathom curve as shown on the chart, about 1 mile northeastward of Palm Point. Shoals make out on both sides of the river mouth to the wreck.

The **anchorage** in the bay is from 1½ to 2 miles southward of Katalla in 6 to 7½ fathoms, with the eastern end of the town bearing between 17° true (N. by W. mag.) and 355° true (NW. by N. mag.). The bottom is hard sand but the holding ground is generally good. There are no dangers if the shore be given a berth of over ¾ mile, but the wreck of the *Portland* and the shoal extending 1½ miles southward from Strawberry Point should be kept in mind.

Approaching from southeastward, vessels pass 2 miles or more southward of Southeast Rock and the breakers between it and Cape St. Elias. From a position 2½ miles west-southwestward of Pinnacle Rock, a 12° true (N by W ½ W mag.) course made good for about 23 miles, will lead to the anchorage in Katalla Bay. Strangers entering Katalla Bay should do so in the daytime and with clear weather.

From Katalla bound westward, vessels can pass 1 to 1½ miles southward of Martin Islands and make good a 273° true (SW by W ¾ W mag.) course for 61 miles to a position 1½ to 2 miles southward of Cape Hinchinbrook. This course if made good should lead in a depth of over 15 fathoms 3½ to 4 miles southward of the sand islets lying 9 to 19 miles westward of Martin Islands.

COPPER RIVER

breaks through the mountains between Miles and Childs glaciers, above which are rapids. Below the rapids the river flows through flats about 5 miles wide in many changeable channels, varying in depth from 5 to 20 feet at high stages of the river, and not navigable. The current is swift and the effect of the tide on the current is only felt near the mouth.

The entire delta is low marshy flats except for sand dunes, 50 to 150 feet high, on the islands and banks of the main channel. From seaward the vicinity of Copper River shows as a vast, rugged mountain range, with numerous glaciers filling its gorges.

From Point Martin to the northeast end of Hinchinbrook Island the coast is fringed by sand islets from 5 to 30 feet high, lying 4 to 5 miles from shore. Shoals extend seaward from these islets, but they have not been developed. Danger will be avoided by giving the islets a berth of about 3 miles; the depth should not be shoaled to less than 10 fathoms (low water). The space between these sand islets and the flats is largely bare at low water, and is navigable only for small craft of 3 or 4 feet draft, in places at high water only.

Alaganik Slough, the westernmost branch of Copper River, is ½ to 1 mile wide, with depths from 5 to 15 feet, depending on the stage of the tide and the river. The mean rise and fall of the tide at the mouth is about 10 feet and at Alaganik 2 to 3 feet, and the flood current is felt to the village.

Eyak River, 6 miles northeastward of Point Whitshed, is connected with Eyak Lake and has a swift current. At favorable stages of the tide it is navigable for small, light-draft craft to the lake.

MIDDLETON ISLAND

is about 7 miles long and has a greatest width of about 2 miles near its southern end. It is flat, about 120 feet high, with clay bluffs and occasional shingle or bowlder beaches, and slopes gradually to its north end, which is a low spit. The island is moist, almost boggy, numerous ponds are formed by rains, and it is covered with grass, flowers, and berries, but there are no trees. It is frequented by wild fowl, and there is driftwood on the shores. There are large bowlders on the beaches and reefs around the island.

Reefs and breakers extend possibly 2 miles eastward and 4 miles southward from the island and are reported to extend 2 or 3 miles off its north end. On the west side kelp extends ½ to 1½ miles from shore. The island is not surveyed and should be approached with caution.

The usual **anchorage** is about 1½ miles off, about 320° true (WNW mag.) from a shallow bight near the middle of the west side of the island, in 12 to 13 fathoms, gravelly bottom. This anchorage is outside the kelp, with the north end of the island bearing 52° true (NNE ⅛ E mag.) and the extreme southwest end 206° true (S ⅛ E mag.). The landing is bad except with a smooth sea.

The **tidal currents** have a velocity of 2 to 3 knots at the anchorage, setting northward on the flood and southward on the ebb.

Wessels Reef, awash at low water and 2 miles long northeast and southwest, lies in latitude 59° 47′ N., longitude 146° 12′ W., or about

16 miles 11° true (N by W ½ W mag.) from the north end of Middleton Island. There is a depth of 30 fathoms or more close to the reef, and with a smooth sea no indication of it can be detected.

PRINCE WILLIAM SOUND.

Hinchinbrook Entrance, between Montague and Hichinbrook Islands, is used by vessels entering Prince William Sound from eastward and southeastward, while Elrington Passage is used by vessels approaching from southwestward. Hinchinbrook Entrance is about 6 miles wide, and clear with the exception of Seal Rocks.

The tidal **currents** in the entrance set directly in or out of the sound. In Hinchinbrook Entrance, Montague Strait, Latouche Passage, and other passages to the westward slack water occurs about the time of high water or low water within Prince William Sound, or 50 minutes before the time of tide at Kodiak; the mean velocity of the current at strength is 1 knot. The ebb current running out against a large swell causes overfalls, especially in the deep water 2 or 3 miles eastward of Zaikof Point, which have been mistaken for breakers. There are also tide rips on the broken ground around Cape Hinchinbrook. The flood entering westward of Montague Island sets northeastward past Montague Point and causes rips between it and Johnstone Point. Outside the entrance along the southeast coast of Hinchinbrook Island the current sets southwestward almost constantly.

Seal Rocks lie off the entrance 6 to 7 miles south-southwestward from Cape Hinchinbrook and over 6 miles from Montague Island. They are two bare rocks, 30 to 37 feet high, surrounded by low rocks. Sunken rocks extend 1 mile northeastward and a short distance southwestward from them. The entire reef within the 10-fathom curve forms an obstruction nearly 2½ miles long.

Hinchinbrook Island has two mountain ridges with elevations up to 2,900 feet, and a low valley between them running through from the head of Port Etches. The tree line is about 1,000 feet above the sea, and the summits of the island are bare. There are a few rocky islets close to the southeast side of Cape Hinchinbrook, and sunken reefs on which the sea breaks in a moderate swell lie ⅜ mile southeastward and southward from the cape. It should be given a berth of over ¾ mile. Cape Hinchinbrook is marked by a lighthouse and fog signal.

Northeastward of Cape Hinchinbrook the seaward face of Hinchinbrook Island is steep, with rocky bluffs at the water, for 12 miles to an open bight with a broad sand beach on the northwest side of Hook Point. From **Hook Point** to **Point Steele**, a distance of 2 miles, the coast is a bluff about 200 feet high, with low, swampy land between it and the mountains, which lie nearly 2 miles back. The coast is clear except from Hook Point to Point Steele, where reefs make out ⅜ mile. A boat can land in good weather on the northwest side of Hook Point and ½ mile northward of Point Steele. A depth of 2½ fathoms was found 3 miles southeastward of **Point Bentinck**, the northeast end of Hinchinbrook Island, and breakers extend out nearly this distance in ordinary weather.

Montague Island is high and mountainous, and wooded to an elevation of about 1,000 feet. At its north end are three prominent points forming Zaikof and Rocky Bays, and low depressions run through from the heads of the bays to the northwest side of the island. **Schooner Rock**, 61 feet high, lies nearly ¼ mile off Zaikof Point, the northeast end of Montague Island, and is marked by a small white house.

For a distance of 20 miles southward of **Zaikof Point** the coast of Montague Island is unbroken and free from outlying dangers, excepting Seal Rocks. Thence southward the coast is more irregular and should be given a good berth in the absence of a complete survey. A vessel is reported to have struck a sunken rock lying about 9 miles northeastward of **Cape Cleare** and possibly as much as 2 miles offshore. The position is doubtful.

Wooded Islands lie 13 to 17 miles northeastward of Cape Cleare and extend offshore about 3 miles. The largest are five in number, 60 to 130 feet high, flat-topped and wooded, with bluff sides. Rips or breakers are reported to extend 1¼ miles northeastward from the northernmost island.

A bank with 18 and 20 fathoms is reported to extend 10 or 12 miles south-southwestward from Cape Cleare in the prolongation of Montague Island. No rocks or breakers were seen except within a mile of the shore.

Tides.—In Prince William Sound high and low water occur about 50 minutes earlier than at Kodiak, and the mean rise and fall of the tides is about 9½ feet. To find the approximate height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges 1.37.

Glacial ice is rarely found in the open waters of Prince William Sound. Ice is discharged by Columbia Glacier, northward of Glacier Island, and is driven into the sound by northerly winds; it may be expected, depending on the winds, from Bligh Island to Bald Head Chris Island and as far south as Storey Island.

There are numerous discharging **glaciers** in Port Wells, the northwest arm of the sound, but the ice rarely reaches the entrance of the port. There is a discharging glacier at the head of Blackstone Bay, but the ice is confined to the bay.

Ice is discharged by Chenega Glacier on the southwest side of the sound, and occasionally drifts eastward as far as Point Helen and the north entrance of Latouche Passage through the passage south of Chenega Island.

During very cold weather ice sometimes forms in the arms of the sound which reach well into the mountains, and is at times sufficiently heavy to impede navigation for wooden vessels.

PORT ETCHES

is an inlet in the southwest end of Hinchinbrook Island, about 4 miles northwestward of Cape Hinchinbrook. The port is about 7 miles long in a 56° true (NNE ½ E mag.) direction and about 1¼ miles wide. It is a secure anchorage, the best in Hinchinbrook Entrance, and is easy of access. The strongest gales are northeast and are not steady, but descend from the surrounding mountains in heavy williwaws of

varied direction, and they sometimes blow hard in Port Etches when comparatively light winds prevail outside. Fresh water can conveniently be obtained from streams in Garden Cove and on the northwest side of Constantine Harbor.

The best anchorage for large vessels is in the middle abreast Garden Cove, 2 miles from the head of the port, in 12 to 15 fathoms, muddy bottom. A flat extends 1½ miles from the head, but the lead is a good guide to avoid it. The swell is quite perceptible in heavy southerly weather.

Garden Cove (Mosquito Bight), on the southeast side, 2 to 2½ miles from the head of the port, is the best anchorage for small vessels. **Garden Island**, wooded and having a break through it, lies in the middle of the entrance; the bight eastward of this island is shoal, and there is no safe passage northeastward of it. **Point Horn**, the southwest point of the cove, is the most prominent of the projecting points on the southeast shore of Port Etches.

To enter Garden Cove pass 400 to 500 yards northward of this point and steer 93° true (NE by E ¾ E mag.). Anchor with Point Horn in line with the southernmost of the Porpoise Rocks, and about 250 yards southeastward of Garden Island, with the break through it open, in 4 to 5 fathoms, sticky bottom. No ocean swell reaches the anchorage, but, as elsewhere in Port Etches, the williwaws are bad in easterly gales, coming both from the head of the port and the head of the cove.

English Bay, on the southeast side at the entrance of the port, is a bight about ⅜ mile wide. It may be used as a temporary anchorage by small vessels, but it is exposed to the ocean swell in heavy weather and open to northerly and westerly winds. Easterly gales blow in williwaws from all directions, but do not raise much sea if anchored well in the cove. The holding ground is good. When entering give the southwest point of the cove a berth of ¼ mile, and anchor in the middle just inside the entrance, in about 5 fathoms.

The two bights on the southeast shore of Port Etches, 1¼ and 3½ miles northeastward of English Bay, are rocky and should be avoided.

Porpoise Rocks, on the northwest side at the entrance of Port Etches, are three principal rocks about 48 feet high, with numerous small rocks between and northeastward of them. The westernmost and largest is flat on top and grass-covered, and a rock covered at high water lies 200 yards westward from it. There is deep water close to the rocks, except on their northeast side where there is foul ground extending to Point Barber at Nuchek, a distance of 1 mile, with no safe channel between. There is kelp around Porpoise Rocks and for a distance of ⅜ mile southwestward of Point Barber.

In good weather steamers sometimes anchor off the shingle spit northwestward of Nuchek to land or receive passengers and freight. It is an uneasy anchorage on account of the swell. The best anchorage is abreast the spit midway between the village and the rocky, wooded knob on the middle of the spit, with the village bearing 95° true (ENE mag.), and the southeast one of the three largest Porpoise Rocks in line with the end of Hinchinbrook Island, bearing 191° true (S by E ½ E mag.), in about 10 fathoms, sandy bottom.

Nuchek is an Indian village on the southeast end of the shingle spit at the southwest end of Constantine Harbor.

CONSTANTINE HARBOR

is the lagoon on the northwest side of Port Etches, its entrance lying 3 miles northeastward of Porpoise Rocks. It is suitable only for small craft on account of the very narrow entrance channel, which is 50 to 100 yards wide with depths of 18 to 19 feet. The tidal currents have considerable velocity in the entrance. The best time to enter is at high water, preferably near slack water. The harbor is generally shallow, but has an area ½ mile long and ⅜ mile wide with depths of 3 to 4¼ fathoms, sticky bottom, but exposed to williwaws.

On the northeast side of the entrance are three small, rocky, wooded islets with overhanging sides. Between them are three rocks bare at low water, and 60 yards south-southeastward from the western islet is a sunken rock, all marked by kelp at slack water. The channel is close to the islets, between them and a shoal with 9 to 10 feet over it extending 600 yards northeastward from Phipps Point.

To enter Constantine Harbor pass 100 yards southwestward of the western islet on a west-northwesterly course, follow the northwest shore at a distance of 125 yards, and pass through the narrow entrance in mid-channel heading for Bear Cape. Keep this course for ½ to ¾ mile from the entrance and anchor about 200 yards from the southeast shore, which affords some protection in northeast gales from the strongest williwaws that come apparently from the head of Port Etches.

A temporary anchorage can be made about ½ mile southeastward of the rocky islets in the entrance of Constantine Harbor, with the southeast Porpoise Rock open from the northwest shore of the port, bearing 242° true (SW by S mag.), in 10 to 12 fathoms, sticky bottom, but there is considerable swell in heavy weather.

Tides.—High and low water occur about 45 minutes before high and low water at Kodiak. The mean rise and fall of the tides is 9 feet. To find the height of the tide for any day at Port Etches multiply the height of the corresponding predicted tide at Kodiak by the ratio of ranges 1.29.

ZAIKOF BAY,

the easternmost of the two bays in the north end of Montague Island, is clear and affords anchorage, but is exposed to northeast winds. Anchorage can be selected with the aid of the chart along the southeast shore, from 2 miles inside Schooner Rock to the head, also on a bar with 10 to 15 fathoms which extends across the bay 2½ miles from the head. A good berth is in 7 to 12 fathoms, depending on the swinging room required, in the cove on the southeast side 2½ miles inside Schooner Rock, with Middle Point bearing 352° true (NW ¾ N mag.). This anchorage is exposed to winds from north to east, and a swell makes in during southeast gales. The only dangers are a short reef marked by kelp off the point westward, and two rocks, bare at half tide and marked by kelp, close to the shore eastward.

A small vessel can anchor in the cove on the southeast side 1⅝ miles from the head, with shelter from northeast winds. Anchor close to the southern side of the point, about 200 yards from the short spit making out from it, in 8 to 10 fathoms. There is no swell,

but the williwaws blow with great force over the lower land inside the point. When the wind hauls southeastward or southward the williwaws come from all directions, and it is well to shift anchorage farther from the spit. There is a small shallow lagoon at the head of the cove, and the bank is steep-to.

ROCKY BAY

has deep water and is exposed to northerly and easterly winds. A small vessel can anchor in good weather about ⅝ mile from the head and 400 yards from the northwest side, in 8 to 10 fathoms. Small craft can anchor in the lagoon, on the southern side 1 mile from the head, where there is a small area with a depth of 10 feet. When entering the lagoon, care should be taken to avoid a reef, partly bare at low water, extending westward and northwestward from the north point at its entrance.

Two ledges, bare at low water and marked by kelp, lie nearly ½ mile off the southern side of Rocky Bay, ⅜ to ¾ mile inside Middle Point. Kelp extends northeastward from them to a 3¾-fathom patch lying ⅝ mile 355° true (NW by N mag.) from Middle Point. Foul ground marked by kelp extends ¼ mile off Middle Point.

A reef, the higher part bare at half tide, extends nearly ¾ mile northeastward from Montague Point.

NORTHWEST SHORE OF HINCHINBROOK ISLAND.

Bear Cape is steep and high, and is the southwest end of the northwest mountain ridge of Hinchinbrook Island.

A small cove in Hinchinbrook Island, 3 miles northward of Bear Cape, has anchorage a little southward of the middle of the entra ce in 8 to 10 fathoms, with shelter from easterly and southeasterly winds.

Shelter Bay has a shallow entrance with strong currents, and can not be used even by small craft. Temporary anchorage, with shelter from offshore winds, may be had about ½ mile from shore, off the middle of the bight at the entrance of Shelter Bay, in 5 to 10 fathoms, sandy and muddy bottom. A shoal, with rocks in places, extends about ¼ mile from the shore in the bight.

A vessel has anchored in 10 fathoms, about ¼ mile northwestward of the **Seven Sisters**, and found the williwaws less strong with southeast winds than at the anchorage 3 miles northward of Bear Cape.

Temporary anchorage, with shelter from offshore winds, may be had southward of the sharp point, with two rocks about 30 feet high close-to, lying ⅜ mile southward of Johnstone Point. The anchorage is about ½ mile off the sand beach and southwestward of the sharp point, in about 10 fathoms, sandy bottom.

Johnstone Point, the northwest end of Hinchinbrook Island, is low and wooded, with a small bluff at the water, and is marked by a light.

Eastward of Johnstone Point the shore is low, and there are two shallow bays or lagoons. The easterly bay has secure anchorage for small craft. The entrance, lying 4 miles eastward of Johnstone Point, is westward of the island in its mouth, and then leads between

two rocks. The one on the west side is bare at half tide and is at the end of a sand spit making out from the shore; it should be given a berth of about 40 yards. The rock on the east side is bare at extreme low water. When inside the rocks, head for the cove in the southwest side of the bay, and anchor in about 3 fathoms, sticky bottom, about 250 to 300 yards from shore, and about half way between the sand spit mentioned above and the south shore of the bay.

Anchorage can be selected off the shore, westward of Middle Ground Shoal, in 12 to 20 fathoms, soft bottom, with shelter from southerly and easterly winds.

Middle Ground Shoal fills the opening between Hinchinbrook and Hawkins Islands and extends into Orca Bay 3 miles. The general depths on the shoal are 2 to 6 feet, and it is a danger for vessels entering Orca Bay from southward. It is marked at its northwest end by a red bell buoy.

Hawkins Island Cut-off, between Hinchinbrook and Hawkins Islands, is navigable only for small craft with local knowledge. It is filled with shoals, and in its eastern end are extensive flats bare at low water and largely covered at high water. There are strong tidal currents in its narrower parts.

ORCA BAY

is an extensive arm on the eastern shore of Prince William Sound between Johnstone Point and Knowles Head, having a length of about 30 miles in an 85° true (NE by E mag.) direction. Its principal importance is derived from the railroad terminal of Cordova on Orca Inlet at its head. Its southern side is formed by Hinchinbrook and Hawkins Islands and is clear with the exception of Middle Ground Shoal. Its north side is indented by large bays, which are of no present commercial importance.

Knowles Head, the southwest end of the mountainous peninsula between Port Gravina and Fidalgo Bay, is a steep massive headland, 1,502 feet high, with a prominent yellowish landslide down its southern face. There is a low depression between it and Porcupine Point, and others northeastward of it running through from Snug Corner Cove and the arms of Two Moon Bay. There are numerous rocks close to shore, but there are no known dangers if it be given a berth of over ½ mile.

Red Head, 4 miles east-northeastward of Knowles Head, is a high hill with a long, low, wooded neck behind it.

Port Gravina has its entrance between Red Head and Gravina Point. It is not surveyed.

Gravina Point, 12 miles eastward of Knowles Head, is low and wooded, and at its southern end is a bare spit with a large and a small clump of trees on it.

Gravina Island, low and wooded, lies 1½ miles west-northwestward of the point and ⅜ mile from shore. Anchorage with shelter from northeast winds can be had about ½ mile from shore between the island and Gravina Point, in about 10 fathoms.

Sheep Bay has its entrance between Gravina and Sheep Points, and extends northward about 7 miles. The bay has not been closely surveyed, the bottom is exceedingly broken, and vessels should proceed with caution. Foul ground extends ¼ to ⅜ mile from the

eastern shore for a distance of 2 miles northward of Sheep Point. Indifferent anchorage in 18 to 20 fathoms can be selected in the middle about 3 miles above Sheep Point and ⅜ mile below the point where the bay contracts. Proceeding with care and preferably at low water, small vessels can follow the deep channel among the islands in the upper part of the bay and select anchorage in 11 to 15 fathoms. The chart is the guide.

Sheep Point is moderately low and wooded at the end, with high land back of it. A wooded islet lies ¼ mile westward of the point, with bare rocks between, and foul ground extends ¼ mile southward and westward from the islet.

Hanks Island, small and wooded, lies ¾ mile eastward of Sheep Point and ½ mile from shore. **Gatherer Rock**, ⅝ mile 124° true (E ½ S mag.) from Hanks Island, is a pinnacle with 13 feet over it and deep water close-to. Broken ground on which the least depth found is 8 feet extends ⅞ mile southward from Hanks Island, and is marked at its south end by a black buoy.

Simpson Bay has depths of 25 to 30 fathoms, muddy bottom, through the middle of its outer part. There are two islets abreast each other, about ¼ mile from the east and west shores, and nearly 1 mile inside the entrance, which are good marks for navigating this part of the bay. A rock, bare at extreme low water, lies 400 yards southward of the east point at the entrance to the inner part of the bay. Passing westward of this rock, the mid-channel is clear to the head of the bay, where there is anchorage, favoring the western shore, between the edge of the flat and the islets southward, in about 15 fathoms. The chart is a sufficient guide.

The east arm of Simpson Bay is clear except near the shores. Good anchorage can be selected on either side of the islands in the upper part of the arm in 12 to 15 fathoms.

Hawkins Island is about 20 miles long and mountainous, with elevations up to 2,025 feet. **Canoe Passage**, dividing the island about 8 miles from its southwest end, is navigable only for boats at high water. The northwest shore southwestward of Canoe Passage is low tundra meadows with patches of trees. Northeastward of Canoe Passage the high land is nearer the northwest shore of the island; there are bluffs in places, and it is more densely wooded.

With the aid of the chart, anchorage can be selected in places along the northwest shore of Hawkins Island with shelter from easterly and southerly winds. The best anchorage is ¼ to ⅜ mile off the spit at the south end of **Cedar Bay** in 9 to 12 fathoms, soft bottom. There is a round, wooded islet at the north end of this spit, and a larger wooded one ½ mile northward. Small craft, entering at high water and passing northward of the rocks awash and sunken inside the entrance, can anchor in the north angle of the lagoon inside the spit, where there is a limited area with a depth of 7 feet.

Channel Islands are wooded and nearly 1 mile long, and lie on the northwest side of the bay 6 miles above Sheep Point. The channel at the islands is ½ mile wide and is called **The Narrows**. A rock with 12 feet over it lies ⅜ mile south-southwestward of the southwest end of Channel Islands, and is marked by a black buoy. The rock is at the north end of a ridge about ⅜ mile long in a south-southwesterly direction, with depths of 13 to 14 fathoms, except near the rock.

ORCA INLET

extends in a southerly direction from the head of Orca Bay. From North Island to Spike Island the western side of the inlet is shoal, and southward of Spike Island the inlet is filled by flats. Northward of North Island it has depths of 25 to 30 fathoms, and a flat extends 1 mile from the head at its north end.

Salmo Point, the northern extremity of Hawkins Island, is just above Channel Islands. **Knot Point**, the northeast end of Hawkins Island, lies 1½ miles south-southeastward from Salmo Point with a bay 1½ miles long and ½ mile wide between. This bay has depths of 3 to 6 fathoms, but a shoal with 9 to 12 feet over it extends across its entrance; it may be used as an anchorage by small vessels that can cross the shoal.

Observation Island, ¾ mile long, high and wooded, lies ⅜ mile northeastward of Knot Point. There is good anchorage 300 to 500 yards westward of Observation Island, in 8 to 10 fathoms, but care must be observed not to foul the cable which lies about 250 yards from the west side of the island.

North Island, ⅜ mile long, low and wooded, lies 1 mile northward of Salmo Point.

From Salmo Point there are three channels to Orca cannery and Cordova.

The deepest channel is north of North Island, and then follows the eastern shore with a least width of 350 yards and a least depth of about 5 fathoms, and is marked by buoys. A rock bare at three-quarters ebb lies 650 yards northeastward from the north end of North Island, and is marked by a light. The shoal on the west side of the channel between North and Observation Islands has depths of 10 to 18 feet, and with care can be avoided by the use of the lead.

The bight in the eastern shore eastward of North Island is filled by a flat, largely bare at low water and steep-to, which extends ¼ mile off the sawmill at the mouth of the stream in the bight; the sawmill wharf extends across the flat to the edge of the channel. The bight extending ½ mile northward from Cordova wharf is filled by a flat, and depths of 19 to 24 feet are found on and a little westward of the line from the wharf to the north point of the bight. With these exceptions the eastern shore is clear.

Orca Channel, between North and Observation Islands, has a depth of about 18 feet and a width of about 300 yards between shoals with 10 to 12 feet over them. It is used by small vessels with local knowledge, but should be avoided by strangers. **South Rock**, bare at half tide, lies 250 yards northward from Observation Island. **North Rock**, covered only at high water, lies midway between Observation and North Islands.

Odiak Channel passes westward of Observation Island, and across the shoal 1¼ miles southward of the island where the depth is 18 to 20 feet. The following directions lead through the channel in a least depth of 18 feet:

Round Salmo Point at a distance of about 400 yards, steer 185° true (SSE ⅛ E mag.) and pass about 200 yards eastward of Knot Point. Then steer 169° true (SE ½ S mag.) with Knot Point astern and the red buoy lying ½ mile northward of Cordova wharf a little

on the starboard bow. Pass eastward of the buoy and steer about 211° true (S ⅛ W mag.) for Spike Island.

Orca cannery is on the eastern shore southeastward from Observation Island. There is a depth of 25 feet at the end of the wharf, and water can be obtained through pipe and hose. There is good anchorage about ¼ mile from the eastern shore abreast or southward of the cannery, in 7 to 9 fathoms.

Cordova, the terminus of the Copper River & Northwestern Railroad, is on the east shore of Orca Inlet eastward of Spike Island. There are stores and hotels, and provisions and supplies of all kinds can be obtained. There is communication by telephone to stations along the railroad, Katalla, and the radio station at Point Whitshed, and by cable to other Alaska ports and Seattle. Water and fuel oil can be obtained at the wharf. Coal may be purchased in limited quantities, and in larger quantities if sufficient notice be given.

Cordova wharf is on the eastern shore ½ mile northward of Spike Island and 2 miles southward of Orca. It is 740 feet long and has a least depth of 29 feet along its face; a depth of 26 feet is found for a distance of 150 yards westward from its northern end.

There is good anchorage in the channel westward of the wharf and Spike Island, in 8 to 10 fathoms. The edge of the flat on the western side of the inlet lies ⅜ mile westward of the wharf and ⅝ mile southwestward of Spike Island. **Spike Island** is about 300 yards long and wooded. The inlet eastward and southward of it is shoal.

CURRENTS, ORCA INLET.

The **tidal currents** in Orca Inlet set southward on the flood and northward on the ebb.

At Orca the strength of the flood occurs 2 hours before the time of high water and the strength of the ebb 2 hours 30 minutes before the time of low water at Kodiak. The mean velocity of the current at strength of flood is about 1.5 knots and at strength of ebb is 0.8 knot. Slack water before the flood occurs 15 minutes before time of low water at Kodiak, and slack water before the ebb occurs 1 hour and 10 minutes after time of high water at Kodiak.

The current sets directly off the face of the Cordova wharf on both flood and ebb, due to the fact that the wharf is built off a small point with a decided bight in the shore on either side.

At Cordova the strength of the flood occurs three hours before the time of high water, and the strength of the ebb three hours before the time of low water at Kodiak. The mean velocity of the current at strength of flood is about 2 knots and at strength of ebb is about 1.4 knots, although at times the current may exceed 3 knots. Slack water before the flood occurs 10 minutes after the time of low water at Kodiak, and slack water before the ebb occurs 30 minutes after the time of high water at Kodiak.

DIRECTIONS, ORCA BAY.

From Hinchinbrook Entrance.—Round Cape Hinchinbrook at a distance of about 1½ miles and follow the western shore of Hinchinbrook Island at a distance of about 1 mile, course 350° true (NW ⅝ N mag.). When the point 3 miles above Bear Cape is abeam,

steer 31° true (N ¼ E mag.) for 7¾ miles to a position 1 mile west-northwestward of Johnstone Point light. Then steer 66° true (NE ⅝ N mag.) for 8¼ miles to a position ½ mile northwestward of Middle Ground Shoal bell buoy. Then steer 79° true (NE ⅜ E mag.) for 17 miles, passing ½ mile off Windy Bay light and to a position 300 to 500 yards southeastward of the black buoy south-southwestward of Channel Islands.

Then steer 58° true (NNE ⅝ E mag.) for 3 miles and pass in mid-channel eastward of Channel Islands and in mid-channel northwestward of North Island. Then haul eastward, pass ¼ mile northward of North Island Rock light and buoy No. 2. Then steer 197° true (S by E mag.) for Orca cannery, follow a mid-channel course as defined by the red buoys and the end of the sawmill wharf, and pass the point on the eastern shore ½ mile southward of the sawmill at a distance of 250 to 300 yards. Continue the course until the north end of Observation Island is abeam. Then steer 216° true (S ⅝ W mag.) and pass the point on the eastern shore 1 mile southward of the cannery at a distance of 300 yards. Then steer 211° true (S ⅛ W mag.) for Spike Island until about ¼ mile from the wharf at Cordova, and then haul in for the wharf.

Approaching Cordova wharf with the flood (south-flowing) current, vessels generally drop an anchor, swing to it, and then make the wharf.

From Northwestward.—Pass about 1 mile southward of Knowles Head and steer 107° true (E by N mag.) for about 12½ miles to a position 1 mile southward of Gravina Point. Then steer 96° true (ENE mag.) for 9½ miles, passing ⅜ mile southward of the black buoy southward of Hanks Island, and to a position ½ mile northwestward of Windy Bay light. Then steer 79° true (NE ⅜ E mag.) for 4 miles to a position 300 to 500 yards southeastward of the black buoy south-southwestward of Channel Islands.

Or, from a position 1 mile northward of Point Eleanor a 90° true (NE by E ½ E mag.) course made good for 47½ miles should lead 1¾ miles southward of Gravina Point, 1½ miles southward of Sheep Point, and to a position ⅜ to ½ mile from the southeastern shore above Windy Bay. Then follow the directions in the third paragraph preceding.

From Southwestward.—Directions from Latouche Passage to Seal Island are given on page 50. Pass about 1 mile southeastward of Seal Island and steer 74° true (NE mag.) for 31 miles, passing 2 miles northwestward of Johnstone Point light and to a position ½ mile northwestward of Middle Ground Shoal bell buoy.

FIDALGO BAY

has its entrance on the eastern shore of Prince William Sound between Goose and Bligh Islands, where it is 5 miles wide, and extends northeastward 22 miles or more. There are mines in Boulder and Landlocked Bays and on the south shore of Fidalgo Bay, between Irish Cove and Whalen Bay.

The waters of the main arm of Fidalgo Bay are deep and free from outlying dangers. Toward the head there are a number of small islets with good water close-to on the channel sides. Vessels may

navigate with safety as far as the entrance to the southeasterly arm at the head of the bay by keeping over ¼ mile offshore.

Goose Island is 1½ miles long, 320 feet high, and wooded, and has two prominent knolls. **Gull Island**, small and rocky, is midway between it and the shore. The passage between the islands should be avoided by strangers, and that between Gull Island and Porcupine Point is foul.

Porcupine Point is a round, wooded bluff, 894 feet high, with a low depression between it and Knowles Head. A rock, bare at low water and marked by kelp, lies 350 yards northward of the point.

Snug Corner Cove, on the northeast side of Porcupine Point, has good anchorage except from northwest winds, but the bottom is irregular and it should be avoided by large vessels. Foul ground extends ⅜ mile from the northeast shore of the cove, and a rocky patch with 4¼ fathoms, possibly less, lies in the entrance ½ mile off the northeast side of Porcupine Point. There is a low divide at the head of the cove and another across Porcupine Point.

To enter Snug Corner Cove, avoid the rock off Porcupine Point and follow the southwest shore at a distance of about ¼ mile. Anchor about ¼ mile off the bight in the southwest shore, before reaching the narrowest part of the cove, in 10 to 11 fathoms, soft bottom. Small vessels can find better shelter from northerly winds in the basin at the head of the cove, in a depth of 5 fathoms. Favor the southwest shore slightly when entering and anchoring. The shores of the basin should be given a berth of over ¼ mile.

Two Moon Bay, on the southeast shore of Fidalgo Bay, 4 miles above Porcupine Point, is 1 mile wide at the entrance, and about 2 miles long to the head of either of its two arms. Low divides extend through to Orca Bay from the head of the arms. There is good anchorage in the bay at the entrance to either arm, and vessels of moderate size can anchor in the arms, depths moderate, and bottom generally sticky. A mid-channel course should be followed in the arms. At the head of the southeast arm is a basin trending southward where small vessels can anchor in 6 to 8 fathoms. The channel is between the west point and a reef bare at low water near the middle of the entrance.

Irish Cove, on the southeast shore of Fidalgo Bay, 7¾ miles above Porcupine Point, is a narrow inlet about 1 mile long. Small craft can find secure anchorage in the widest part near its head in 5 fathoms. To enter favor the eastern side to the narrows and then keep in mid-channel.

A small wharf of the Fidalgo Mining Co. is located on the south shore, 1¾ miles southwestward of the entrance to Whalen Bay.

Whalen Bay is 2½ miles long with an average width of 0.3 mile. Mud flats bare at low water, extend across the bay for a distance of ½ mile from the head.

Small vessels may enter the bay on a mid-channel course, and find anchorage in 7 to 10 fathoms in mid-channel 1 mile inside the entrance.

A group of islands and islets 180 to 190 feet high lies near the head of Fidalgo Bay. They are connected by mud flats to the shores to the eastward. A single islet lies about 900 yards southwestward of this group, the passage to the bight northward lying between the two. This bight has not been recommended as an anchorage. Its head is

obstructed by mud flats, and it is reported that strong williwaws will be encountered.

The entrance to the southeast arm lies 2 miles southeastward of the group of islands described above. A **dangerous rock**, bare at half tide, lies on a line between the two entrance points, 460 yards off the easterly point. This rock is surrounded by deep water, and may be approached within 200 yards.

The head of the arm terminates in a narrow passage about 60 yards wide and ½ mile long, which opens out into a circular lagoon ¾ mile in diameter. It is reported that this passage is foul and should not be attempted. Opposite the outer entrance to this passage, the head of the bay is obstructed by mud flats, which, at low tide, are bare, or covered with 1 to 2 fathoms of water. For this reason the head of the bay should not be approached closer than 1 mile.

Anchorage for vessels of any size, well sheltered from wind and sea, may be found in mid-channel ⅝ mile northwestward from the rock awash at half tide, described above. The anchorage is in about 15 fathoms, mud bottom.

Small vessels may find anchorage near the head of the southeast arm, in mid-channel, ¾ mile beyond the rock. There is about 7 fathoms, mud bottom, in this position.

Fish Bay is on the northwest shore of Fidalgo Bay, 9 miles above Porcupine Point. It is an indifferent anchorage and should be avoided by large vessels. The williwaws are heavy with northeast winds, drawing through the bay from the high mountains above its head. A small, wooded island lies just inside the entrance ¼ mile from the west side. The channel is eastward of the island and is obstructed near the middle by a rock with 3½ fathoms, possibly less. Rocks, bare at low water, lie 200 yards off the eastern point at the entrance. Anchorage can be had in the middle, ¼ to 1 mile above the island, in 8 to 13 fathoms, bottom soft in places. A flat extends ⅞ mile from the head to the prominent point on the southeast side 1¼ miles above the island.

Landlocked Bay is on the northwest shore of Fidalgo Bay east of Bidarka Point. It has a clear width of about 1 mile at the entrance, contracts to 400 yards at 2 miles from the entrance, and then widens again to ⅜ mile. There is secure anchorage in the widest part above the narrows in 14 to 15 fathoms, sticky bottom. The bay is easily entered during daylight, but the shadows cast by the hills at night obscure the narrow entrance, rendering it difficult for vessels not equipped with a searchlight.

The islands on the eastern side below the narrows have covering rocks near them. On the northwest side at the entrance of the narrows is an abandoned wharf. Near the middle of the narrows is a rock with 6 feet over it and marked by a buoy. The deepest water is northwest of the buoy, but the northwest shore abreast it should be given a berth of about 100 yards. There is a flat at the head of the bay with an islet at its lower edge. On the north side just below the edge of the flat is a wharf of the Three Man Mine. Water can be conveniently obtained from a fall on the south side of the bay southeastward of the wharf.

To enter Landlocked Bay follow the western shore at a distance of about ½ mile, pass in mid-channel westward of the islets below the

narrows, and pass about 50 yards northwestward of the buoy in the narrows, above which the mid-channel is clear.

Bidarka Point is a wooded hill 912 feet high with a lower strip at its south end having considerable grassy areas. A shoal extends ¼ mile southward from the point.

Boulder Bay, between Bligh Island and Bidarka Point, is about 4 miles long and 2 miles wide at the entrance. There are several dangers in the bay, the depths are very irregular, and there is no desirable anchorage. On the east side at the head of the bay is a wharf, for vessels, of a copper mine.

A reef, bare at lowest tides, lies ⅝ mile from the western shore of the bay; its eastern end, with 15 feet over it, lies ¾ mile from the western shore and ⅞ mile 197° true (S by E mag.) from the southeast end of the islands at the entrance to Tatitlek Narrows.

A sunken rock, nearly awash at low water, lies ⅜ mile from a point on the eastern shore, and 1⅝ miles northwestward from Bidarka Point. It is marked on its southwest side by a red buoy.

A reef, partly bare at low water, lies 400 to 800 yards southeastward from the small wooded island in the middle near the head of Boulder Bay.

To enter Boulder Bay, bring the houses on the east side at the head to show just open westward of the wooded island in the middle near the head, bearing 17° true (N by W mag.), and stand in on this line, passing about 200 yards westward of the red buoy. On approaching the island, edge a little westward and pass midway between it and the grassy, partly wooded islet near the western shore. Then steer for the wharf.

Bligh Island, on the eastern shore of Prince William Sound, is 4½ miles long, 3 miles wide, and mountainous. The southwest end of the island is a steep wooded head 1,630 feet high with some yellow landslides near the water. On its northwest side are a number of islands with foul ground between.

Reef Island, off the west side of Bligh Island, is 1 mile long, level and wooded, and has a single knoll, 338 feet high, in the middle, which distinguishes it from Goose Island. A rock, bare at low water, lies ¼ mile 208° true (S mag.) from the southwest end of the island. The rock is marked by a buoy.

Bligh Island Reef is ¾ mile long with depths from 7 to 28 feet. It is marked at its south end by a buoy. The wreck of the *Olympia* stands on the reef and has the appearance of a vessel underway. The passage between the reef and Reef Island has deep water and is used at times by vessels rounding Bligh Island; the line of the west end of Busby Island and Rocky Point, bearing 23° true (N ½ W mag.), leads through the middle of the channel.

Busby Island, off the northwest end of Bligh Island, is 1¼ miles long, 275 feet high, and partly wooded. Its western point is long, level, and wooded, and is surrounded by a reef to a distance of nearly ¼ mile. The point is marked by a light, and a part of the wreck of the *Saratoga* shows near the end of the reef.

Currents.—At the entrance to Fidalgo Bay, north of Goose Island the mean strength of current is about 0.6 knot; slack water before flood and ebb occurring about two hours before the time of low water and high water, respectively, at Kodiak.

TATITLEK NARROWS AND VIRGIN BAY.

Tatitlek Narrows separates Busby and Bligh Islands from the main shore, and offers a more direct route for small craft between Port Valdez or Ellamar and points on Port Fidalgo. The channel has a depth of about 4 fathoms, but it is narrow with foul ground on both sides and should not be used by vessels in the absence of aids.

Tatitlek is a small Indian village on the northeast shore at the southeast end of the narrows.

Virgin Bay is a shallow bight ½ to ¾ mile long on the northeast shore of Tatitlek Narrows. There is little water in the northern and southern ends of the bay, and on the north side in the entrance is a long reef bare at low water. The approach is marked by two buoys. There is a depth of 10 to 12 feet in the approach to the wharf, which is on the northeast side and has a depth of 12 feet at its end. Fresh water can be had at the wharf. Vessels now use the ore dock which has been built on the end of the reef ¼ mile westward (true) from the wharf, with which it is connected with an aerial cable.

Ellamar, on the northeast side of Virgin Bay, has a post office, store, hotel, and other buildings. Ore from the copper mine is shipped to Tacoma.

Anchorage can be had ¼ to ⅜ mile from the northeast shore of Tatitlek Narrows, and ½ to ¾ mile westward of the ore dock at Ellamar, in 12 to 16 fathoms, sticky bottom. Two buoyed shoals lie in the narrows in the approach from northwestward to Virgin Bay—one with 15 feet over it ⅜ mile 298° true (W mag.), and the other with about 17 feet over it about ¾ mile 287° true (W by S mag.), from the southeast point of Virgin Bay.

VALDEZ ARM,

the northern arm of Prince William Sound, extends about 13 miles in a 32° true (N ¼ E mag.) direction from Busby Island and Point Freemantle to the northern end of Valdez Narrows, and then turns to about 85° true (NE by E mag.) for 11 miles to the town of Valdez at its head. The water is very deep and there are no outlying dangers except Middle Rock. There are few anchorages on account of the great depths. Rocks bare at low water lie ¼ mile from shore and 2⅝ miles northward of Point Freemantle, and with this exception the western shore is bold to Valdez Narrows.

Sawmill Bay, on the western shore 9 miles northward of Point Freemantle, is ⅜ mile wide at the entrance and 1½ miles long in a 349° true (NW ½ N mag.) direction. Entering in mid-channel, there is a secure anchorage with a clear width of over ¼ mile in the expansion ½ mile inside the entrance, in 9 fathoms, sticky bottom. The south and west ends of the basin forming the anchorage are shoal, and a flat fills the head of the bay down to the narrows at the north end of the basin.

Rocky Point, off the western end of the peninsula between Tatitlek Narrows and Galena Bay, is a chain of low, rocky islands, the outer and highest one about 30 feet high and having some scattered trees. The south point of Galena Bay is a wooded islet joined to the shore by a low spit. A rocky, grass-covered islet lies ¼ mile northward from the south point at the entrance.

Galena Bay is about 5 miles long in a general easterly direction, with a width of ¾ to 1¼ miles, but narrowed at 3 miles from the entrance to ¼ mile. The depths are great throughout except for flats off the mouths of streams. There is an islet on the north side below the narrows, and a rock with 12 feet over it lies 300 yards 62° true (NE by N mag.) from the islet. Care should be observed in the vicinity of the 13 and 17 fathom soundings in the narrows, as that area is not thoroughly developed. The only anchorage is about ¼ mile southward of the islets on the north side at the head of the bay, in about 15 fathoms, bottom soft in places. A flat extends ⅝ mile from the southeast end of the head of the bay.

A group of rocky, grass-covered islets extends ½ mile off the north point at the entrance of Galena Bay. There is anchorage in the middle of the cove northeast of the islets, in 10 to 12 fathoms, sticky bottom.

Jack Bay, on the eastern shore southward of Valdez Narrows, is 5½ miles long in a 118° true (E mag.) direction, with a width of ¾ mile at the entrance and ¼ to ⅜ mile in the upper 3 miles. Anchorage can be had in mid-channel or closer to the southern shore 1½ miles inside the entrance in 10 to 12 fathoms, bottom sticky in places; also for small vessels in the entrance of the short arm, northeastward of the islands in the bay, in the same depths. The passage northward of the islands and that between the islands and the point eastward are not thoroughly developed and should be used with caution. The first cove on the south side is foul. Shoals make out about 400 yards from the southeast end of the second cove. A flat extends about ⅝ mile from the head of the bay to an islet. A small vessel can anchor about 300 yards westward of the islet and the same distance from the south shore in about 15 fathoms.

Valdez Narrows is about 2 miles long and ¾ mile wide, with deep water and bold shores, especially the eastern one. A wooded islet lies 300 yards from the western shore at the north end of the narrows. **Middle Rock**, a pinnacle barely covered at extreme high tides, lies in the middle of the north end of the narrows 850 yards 85° true (NE by E mag.) from the islet and ½ mile from the eastern shore, and is marked by a light.

The bay (locally known as **Shoup Bay**) at the mouth of **Shoup Glacier** is closed by a sand spit nearly all dry at low water and over which the best depth is about 7 feet. This bay is often filled with floating ice, some of which escapes into the port when the wind and tide are favorable. A wharf of the Cliff mine extends into Port Valdez from the easterly point at the entrance to Shoup Bay. Vessels generally go to the wharf port side to, and the depth is said to be ample.

Swanport is a small anchorage under Jackson Point, the western end of the eastern one of the two islands on the south side of Port Valdez, 3¾ miles from Valdez. The bottom drops off abruptly, but a small vessel will have swinging room if anchored in 10 fathoms 350 yards 242° true (SW by S mag.) from Jackson Point and the same distance from the south shore. This is the best anchorage between Valdez Narrows and Valdez. The cove inside the island is nearly filled by a flat, and vessels have been beached on it.

A temporary anchorage for large vessels can be had about ½ mile from the north shore and ¾ mile eastward of **Gold Creek**, in about 30 fathoms.

Fort Liscum is an Army post and wharf on the south shore 1 mile eastward of Jackson Point. Water can be had at the wharf.

Valdez is an important town at the head of Port Valdez. There are stores, hotels, assay office, and ore-testing plant, and provisions and supplies of all kinds can be obtained. Most of the vessels trading to Prince William Sound call at Valdez, and there is communication by small local craft with other places on the sound. From Valdez a Government trail and telegraph line lead into the interior of Alaska, and there is an overland mail service. There is cable communication with other points in Alaska and Seattle.

Two wharves extend out from the town to the edge of the flat. The northwest one is the regular steamer wharf, and vessels go to its end, which is about 200 feet long on the face. Approaching the wharf vessels should not go inside the line of its face. The other wharf is owned by the town of Valdez.

A wharf of the Midas mine is located on the south side of Port Valdez, about 1½ miles eastward of Fort Liscum. The depth is said to be ample. Approaching the wharf from westward care should be taken to give sufficient berth to the edge of the flat making off from Solomon Gulch.

Currents.—At the entrance to Valdez Arm, west of Rocky Point, the mean strength of current is about 0.6 knot, slack water before the flood occurring 30 minutes before the time of low water and slack water before the ebb occurring about 30 minutes before the time of high water at Kodiak.

DIRECTIONS, PORT VALDEZ.

From Hinchinbrook Entrance.—Give Cape Hinchinbrook a berth of 1½ miles, and when the lighthouse bears 70° true (NE ⅜ N mag.), distant 2¼ miles, steer 349° true (NW ½ N mag.), keeping 1 mile off the southwesf shore of Hinchinbrook Island. This course made good for 37 miles from Cape Hinchinbrook, or 30 miles from Bear Cape, should lead to a position 4 miles from Bligh Island with the highest peak at the southwest end of the island bearing 101° true (ENE ½ E mag.), and Bligh Island Reef buoy should then be on the starboard beam, distant 2 miles.

Then steer 30° true (N ⅛ E mag.) for 17 miles, passing 1½ miles westward of Busby Island light, 1 mile westward of Rocky Point, and to a position ¼ mile off the eastern shore about halfway through Valdez Narrows; Middle Rock light should be ahead or a very little on the port bow. Then steer 48° true (N by E ¾ E mag.) for 1½ miles, following the eastern shore of Valdez Narrows in mid-channel eastward of Middle Rock light. When Entrance Island (close to southeast shore) is abeam, distant about ⅜ mile, an 82° true (NE ¾ E mag.) course made good for 10 miles will lead to the wharves at Valdez.

From Latouche Passage.—From a position in the northern entrance of Latouche Passage, about ¾ mile westward of Point Grace, steer 50° true (NNE mag.) for 5¼ miles to a position 1 mile eastward of Point Helen light. Then steer 26° true (N ⅛ W mag.) for 20 miles and pass 1 mile westward of Seal Island. When Seal Island light bears 141° true (ESE mag.), distant a little over 1 mile, steer 51° true (NNE mag.) for 8 miles, passing 1¾ miles southeastward of Smith Island

light and to a position with the light bearing 276° true (WSW mag.), distant 2½ miles. Then steer 24° true (N ⅜ W mag.) for 20 miles to a position 4 miles from Bligh Island, with the highest peak at the southwest end of the island bearing 101° true (ENE ½ E mag.). Bligh Island Reef buoy should then bear about 79° true (NE ½ E mag.), distant 2 miles. Then steer 30° true (N ⅛ E mag.) and follow the directions in the preceding paragraph.

ISLANDS IN PRINCE WILLIAM SOUND.

Glacier Island is on the north side of Prince William Sound, westward of the entrance of Valdez Arm. It is mountainous and indented by a number of bays, of which Chamberlain Bay and Jackson Cove are the only ones that have been sounded.

Chamberlain Bay, on the south side of Glacier Island, is exposed southward, but affords anchorage for small vessels about ⅜ mile from the head, in about 15 fathoms, muddy bottom. Rocks, partly bare at low water, extend 400 yards from the western side of the bay about ⅝ mile from the head.

Jackson Cove, on the west side of Chamberlain Bay, is a secure harbor for small craft. The entrance has a least width of about 50 yards and a depth of about 12 feet; at the narrowest part of the entrance favor the north side. The upper half of the cove has rocks on both sides, and a careful mid-channel course should be followed. Anchorage can be selected in the lower part of the cove, in 10 to 15 fathoms, also about 350 yards from the head, in about 5 fathoms. A divide about 75 feet high extends through to Jackson Hole.

Naked, Peak, and **Storey Islands** form a group about 8 miles long north and south, with a greatest width of 6 miles, are 700 to 1,317 feet high, and are wooded to the summits. A small wooded island lies ¾ mile off the south side of Naked Island.

The bottom in the vicinity of the islands, including the passages among them, is rocky and exceedingly broken. As a measure of safety it is considered advisable for vessels, especially large ones, to avoid areas with depths less than about 20 fathoms in the vicinity of the islands and to avoid the passages between the islands.

A sunken rock with about 6 feet over it at low water was reported between Naked Island and Smith Island, the position, however, being very doubtful. It is possible that the rock may exist in the vicinity of the broken ground shown on the chart near Naked Island and Smith Island. It is safer, therefore, for vessels to keep in the deeper part of the passage, preferably outside the 50-fathom curve. See the directions for Passage Canal from Hinchinbrook Entrance.

The anchorages about Naked Island are indifferent. Large vessels can anchor in the southerly part of the large bay on the north side of Naked Island, in 20 to 30 fathoms; and small vessels can anchor in the easterly bight of this bay in 15 to 20 fathoms.

Small vessels can anchor in the cove on the east side of the bay on the south side of Naked Island, also at the north end of the bay, in about 16 fathoms.

The southerly bay on the west side of Naked Island has anchorage for large vessels in the outer bight on its southeast side, in about 25 fathoms, avoiding, however, the 14-fathom sounding shown on the chart just southwestward of the anchorage. Small vessels can anchor at the southeast end of the inner bight, in 18 to 20 fathoms.

Small craft can anchor in the small bight on the southwest side of Peak Island, also between Storey Island and the small island close to its southeast side. The entrance to the latter anchorage is from southwestward, between the small island and the islet between it and Storey Island; and the islet must be kept close aboard to avoid a reef extending from the small island. A reef bare at low water extends, also, southward and southeastward from the small island, as shown on the chart.

Smith Island is 3 miles long, wooded, about 500 feet high, and lowest at its southwest end. The northeast point of the island is marked by a light. A bank with depths of 34 fathoms or less extends 3 miles northeastward from Smith Island; depths of 11 and 12 fathoms, rocky bottom, were found on the bank for a distance of 1 mile from the island, but it has not been thoroughly developed and at least this part of the bank should be avoided.

Little Smith Island, bluff, wooded, and about 350 feet high, lies ⅜ mile off the southwest end of Smith Island. Rocky patches, on which the least depth found is 8 fathoms, lie 1¼ miles northwestward and north-northwestward of Little Smith Island.

Seal Island is about ⅜ mile in diameter, wooded, about 350 feet high, and rounded in outline. There are two bare, rocky islets close to its eastern end, and a small bare rock about 200 yards off its west end. The northwest point of the island is marked by a light. Rocky, broken areas extend 1 mile northeastward and northward from Seal Island. The least depth is 2 fathoms on the northwest end of the broken areas, lying 1 mile northward of the light, and is marked by a buoy.

The reef between Seal Island and Green Island is described with the latter.

PRINCE WILLIAM SOUND, NORTHWEST PART.

The principal approaches to Passage Canal and the canal itself have been surveyed, and offer little difficulty for navigation with the aid of the chart. These waters, including the Knight Island group and both shores of Knight Island Passage, are characterized by rocky and exceedingly broken bottom. Differences in depth of 50 fathoms between adjacent soundings are not uncommon, and it is probable that on the broken areas there may be less water, and possibly dangers, not obtained by the survey. As a measure of safety, vessels should avoid broken areas in these waters where abrupt changes in depth are indicated by the chart to depths less than 50 fathoms.

Lone Island is 2¼ miles long, wooded, comparatively level, and 553 feet high. Foul ground extends nearly ½ mile northward, and a bank on which 21 fathoms was found, extends 1 mile northward from the island. Broken ground, on which the least depths found are 11 to 16 fathoms, extends 1½ miles southward from the island.

Dutch Group are several wooded islands and bare rocks, the largest having elevations up to 150 feet. Foul ground extends 1¼ miles southward of the group to two prominent rocks about 5 to 10 feet high.

Fool Island is wooded and about 50 feet high. A rock bare at low water lies 600 yards south-southeastward of Fool Island.

Egg Rocks are prominent, bare rocks, except for some grass, and lie 1½ miles westward of Fool Island.

Perry Island is wooded to a height of about 1,000 feet, and is prominently marked on its northeast side by a round peak 1,618 feet high, the summit of which is small, bare, and dome shaped. The bays indenting the island are anchorages for small craft only, on account of the foul, rocky, and broken bottom.

Foul ground extends ½ mile eastward from the easterly end of Perry Island, and nearly 1 mile southeastward and southward from the southeast point of the island.

The bay indenting the southeast side of Perry Island has an indifferent anchorage at the head for small craft. On account of the broken bottom care should be exercised, especially in the vicinity of the 13 and 17 fathom soundings shown on chart 8517 (1915 edition).

East Twin Bay, indenting the north side of Perry Island, has anchorage for small craft on the southwest side of the head, in about 11 fathoms, the area of soft bottom being small. A mid-channel course should be followed until up with a prominent rock about 20 feet high, which lies near the middle ¾ mile from the head. Pass northeastward of that rock and follow the northeast shore at a distance of about 150 yards. A rock with 6 feet over it lies 450 yards 135° true (ESE ½ E mag.) from the prominent rock and 275 yards from the northeast shore.

West Twin Bay, indenting the northwest side of Perry Island, is not an anchorage on account of the rocky, broken bottom. Small craft entering should favor the northeast side to the narrow part 1¼ miles from the head, and then favor the southwest side, passing westward of a rock, about 25 feet high, which lies near the middle ⅝ mile from the head.

From the point on the southwest side at the entrance of West Twin Bay a chain of islets and foul ground extends over 1 mile northwestward, its end on which the least depth found is 6 fathoms, lying ⅜ mile northwestward of the outer islet.

Esther Island is mountainous, wooded to a height of about 1,000 feet, and the summits are bare rock. The peak, 2,019 feet high, on the southeast point of Esther Island, and the sharp, twin peaks 1,821 and 1,822 feet high, on the southwest point, are prominent.

Esther Rock, lying 1 mile westward of Esther Point, Esther Island, is about 15 feet high and bare except for some grass. A rocky area with depths less than 50 fathoms extends ¼ mile northward and eastward and ½ mile southeastward and southward from Esther Rock.

A rock, bare at lowest tides, is reported to lie about ¾ mile off the south point of the bay (locally called Granite Bay) on the west side of Esther Island.

Culross Island is mountainous and wooded to a height of about 1,000 feet.

Culross Bay, indenting the north side of Culross Island, is clear, but is a poor anchorage. The prevailing northeast winds send considerable swell up the bay. A small area of mud bottom is found near the head; it appears to be a soft, thin layer over rock, and anchors do not hold well in it.

Port Wells, Cochrane Bay, and **Blackstone Bay** are not surveyed, some sounding having been done by exploring parties as shown on the chart. Some mining development has been done on Port Wells.

Hobo Bay is on the west side of Port Wells just northward of Bettles Bay. A mining company has a wharf on the north side of the bay, with a depth of about 19 feet at its end. A bar with a depth of about 5 fathoms extends across the entrance of the bay. Vessels entering follow the north side of the bay at a reported distance of 100 yards. It is reported also that there is good anchorage in the bay, in 6 to 7 fathoms.

Golden is a mining camp on the eastern shore of Port Wells, about 1 mile northward of the junction with Esther Passage. Steamers anchor 200 to 300 yards southward of the little island off Golden, in about 20 fathoms, rocky bottom. It is regarded as a poor anchorage, and it is probable that the anchor will not hold with strong winds drawing down the canal. The area between the island and the shore is bare at low water.

PASSAGE CANAL

has its entrance at the southwest end of Port Wells between Point Pigot and the peninsula separating Cochrane and Blackstone Bays. The canal trends west-northwestward for 4 miles, and then southwestward for 8 miles.

The canal is 1 to 1½ miles wide, has great depth and is clear except a very few places near the shores. The shores rise abruptly to elevations of 2,000 to 4,000 feet, and are wooded to an elevation of about 1,000 feet. The higher peaks are bare or snow-covered rock.

Point Pigot is a peninsula lying between Pigot Bay and Passage Canal, and across it low divides extend from Entry Cove and Logging Camp Bay. A high-water islet about 50 feet high marks the south end of the point.

A rock, bare at lowest tides, lies ¼ mile off the east end of Point Pigot and ¾ mile 73° true (NE mag.) of the high-water islet at the south end of the point.

Entry Cove lies westward of the south end of Point Pigot. Good anchorage with a clear width of 300 yards can be had in the entrance, in 14 fathoms, soft bottom. The only danger is a rock bare at low water which lies 150 yards westward of the high-water islet and the same distance from shore.

Passage Bay, on the south side of the canal 6 miles above Point Pigot, has depths of 30 to 35 fathoms, muddy bottom, through the middle. Foul ground fills the narrow parts at the head of the bay; approaching slowly, a small vessel can select anchorage just below this foul ground, in 15 to 20 fathoms.

The bight on the southeast side of Passage Bay is obstructed near the middle, about on the line joining the points of the bight, by a rock with 4 feet over it. Anchorage with a clear width of ¼ mile can be had in the northeasterly part of this bight, with the westerly point of the bay in range with the point beyond, bearing 322° true (NW by W ⅞ W mag.), in 15 to 20 fathoms, muddy bottom.

Anchorage in 15 to 20 fathoms, sticky bottom, can be had on the shoal which is about ½ mile long and extends ¼ mile from the south side of the canal at a point 1 mile above Emerald Isle and 3½ miles from the head. The least depth found by a careful examination is 29 feet at the southwest end of the shoal.

Small craft can anchor in the cove at the northwest end of the head of the canal, in 6 to 12 fathoms.

The currents in Passage Canal have little velocity.

DIRECTIONS, PASSAGE CANAL.

From Northeastward.—Passing southward of Glacier Island and northward of Storey Island, a course can be shaped for the highest peak of Perry Island, which will lead southward of the two bare rocks southward of the Dutch Group. Or, a 250° true (SW ¼ S mag.) course for the peak of Perry Island will lead ⅜ mile southeastward of the two bare rocks southward of the Dutch Group, and a 270° true (SW by W ½ W mag.) course for the peak of Perry Island will lead outside the 50-fathom curve on the shoal northward of Lone Island.

Pass ½ to ¾ mile southward of the two bare rocks southward of the Dutch Group, and steer about 293° true (W ⅜ S mag.) for about 4 miles, heading for the southwest point of Esther Island, to a position ¼ mile northward of Point Perry, the north end of Perry Island. A 280° true (WSW ⅜ W mag.) course for 12 miles will then lead to the middle of the entrance of Passage Canal, passing ¾ mile northward of Point Culross.

From Hinchinbrook Entrance.—Passing 2 miles southwestward of Cape Hinchinbrook lighthouse steer, 323° true (NW by W ¾ W mag.) for 25 miles, heading for the 1,235-foot peak on the east side of Naked Island until Smith Island light is abeam, distant 3½ miles. Then steer 275° true (WSW mag.) for 7 miles heading for Point Eleanor until the west end of Naked Island opens from its south point.

Then steer 319° true (WNW ⅛ W mag.) for 11 miles heading for the north island of the Dutch Group until the northwest point of Lone Island is abeam distant 1½ miles. Then steer 286° true (W by S mag.) for 3½ miles heading for Point Perry to a position ½ mile southward of two bare rocks southward of the Dutch Group.

From Knight Island Passage.—From a mid-channel position in Knight Island Passage between Herring Point and Crafton Island, steer 336° true (NW ⅝ W mag.), passing ¾ mile off the southwest point of Perry Island. This point is composed of light cobble stones and is prominent on account of this light color. Continue the course for nearly 18 miles, give the northeasterly end of Culross Island and Point Culross a berth of ¾ mile in rounding the island, and steer 280° true (WSW ⅜ W mag.) to the middle of the entrance of Passage Canal.

KNIGHT ISLAND AND ASSOCIATED ISLANDS.

Knight Island is 22 miles long and very rugged, the peaks having elevations up to 3,280 feet. It is wooded to an elevation of about 1,000 feet, and above this is grass covered. Three mountainous, sparsely wooded islands, called Disk, Ingot, and Eleanor, extend 6 miles northward from Knight Island to Point Eleanor, the north end of the group.

Eleanor Island is about 4 miles long, has elevations up to 834 feet, and bluff, rugged shores. Broken ground extends ⅜ mile northward and northwestward from Point Eleanor. The bay on the northwest side of Eleanor Island is deep and clear. There is anchorage

for small vessels in the south arm, about ⅜ mile from the head, in about 20 fathoms.

Near the eastern point of Eleanor Island, 2 miles southeastward of Point Eleanor, there is a rocky islet with a few trees and foul ground inside of it. A bare rock lying ¼ mile southeastward of the islet should be given a berth of ¼ mile.

A group of prominent bare rocks, close together and about 12 feet high, lie over ½ mile off the southeastern point of Eleanor Island and 3 miles southeastward of Point Eleanor. There is broken ground, with depths of 6 to 7 fathoms, between them and Eleanor Island. A bare rock about 5 feet high lies ½ mile southward of the group of bare rocks; it should be given a berth of over ¼ mile when southeastward of it.

Upper Passage, separating Eleanor and Ingot Islands, is generally deep and suitable for small craft. An island, 1 mile long and its northern end joined at low water to Eleanor Island, lies in the passage. In the narrowest part of the passage between this island and Ingot Island, favor, if anything, the northeast side of the channel. A ledge, with 5 fathoms over it, possibly less, lies in the middle of the southeastern entrance of Upper Passage 600 yards southeastward from the southern end of the island in the passage.

Entrance Island, a prominent wooded island, 269 feet high and with deep water all around it, lies 600 yards southward from Eleanor Island and on the northern side at the southeastern entrance of Upper Passage.

Sphinx Island, a larger and higher wooded island, lies ⅝ mile southward of Entrance Island and ⅜ mile eastward of Ingot Island; there is deep water all around it.

Ingot Island, lying between Upper and Lower Passages, is 4 miles long, over 1 mile wide, and 1,114 feet high. A prominent wooded island 246 feet high lies ¼ mile off the northwest end of Ingot Island.

Disk Island, on the northeastern side of Lower Passage, is about 1 mile in diameter and 677 feet high. The narrow channel between it and Ingot Island is blocked by reefs. A bay with two narrow entrances makes into the southwest side of the island. The main entrance is 50 yards wide with a depth of 3 fathoms, and there is a depth of 13 fathoms in the bay.

Two small bare rocks, close together and nearly awash at high water, lie ½ mile 115° true (E ¼ N mag.) from the southeast point of Ingot Island, with deep water between. The rocks should be given a berth of ¼ mile when northeastward of them. A rock, with 3½ fathoms on it and which should be avoided, lies ½ mile 109° true (E ¾ N mag.) from the bare rocks, with broken ground between.

Lower Passage is a deep navigable channel, suitable for small vessels, at the northern end of Knight Island, between it and Disk and Ingot Islands. A ledge, on which the least depth obtained is 4 fathoms, extends 300 yards northward from the turning point on the south side of Lower Passage southeastward from Disk Island. Broken ground, on which the least depth obtained is 6½ fathoms, extends into the passage 400 yards from the southwest shore just northwestward of the entrance of Louis Bay. A rock, bare at half tide, lies 350 yards from the western shore, ¾ mile inside the northwest end of the passage. There is foul ground from this rock to the head of the cove ½ mile southward.

A rock with 4½ fathoms, possibly less, lies nearly ⅜ mile northwestward from the northern end of Disk Island. Another rock with 5 fathoms over it lies nearly ½ mile from Ingot Island and over ¾ mile 42° true (N by E ¼ E mag.) from the southern point at the northwestern entrance of Lower Passage. These rocks are well out of the usual track of vessels going through Lower Passage.

Entering Lower Passage from eastward, vessels should pass southward of the two small outlying bare rocks (see the description preceding). Give the prominent turning point on the south side of the passage southeastward of Disk Island a berth of 300 yards when northward of it, and follow the southern side of Disk Island at about that distance until up with its southwestern end. Then steer 349° true (NW ½ N mag.) and pass about ¼ mile northeastward from the southern point at the northwestern end of the passage.

Louis Bay, at the southern end about halfway through Lower Passage, is ½ mile wide at the entrance, and affords anchorage for small vessels 250 to 300 yards from the head of either of its two arms in about 15 fathoms. The western arm is clear so far as known.

The eastern arm of Louis Bay has a very broken bottom, and small vessels entering should proceed with caution. A rock with a depth of 5 feet lies 175 yards from the eastern shore and 350 yards northward from the entrance of the eastern arm. The eastern arm is ⅛ to ¼ mile wide; a ledge makes out about 30 yards from the western point (a wooded islet) at the entrance. When inside the entrance of the eastern arm, favor the western side to avoid three rocks which are bare at lowest tides; one lies 100 yards off a point on the east side 300 yards northward of the houses at the head; the other two lie 225 yards northward of the same point and the same distance from the east side.

Bay of Isles is on the eastern side of Knight Island, 260° true (SW ⅝ W mag.) from Seal Island. It has numerous islets and pinnacle rocks, sunken and awash, and is suitable only for small vessels, proceeding with caution and preferably at low water. There is secure anchorage in the South and North Arms, the latter being easier of access. The depths in the bay are great, and the deep water extends close to the rocks, which are not marked by kelp.

To enter Bay of Isles, steer 260° true (SW ⅝ W mag.) with Seal Island astern, and pass in mid-channel northward of the islets lying in the middle of the bay. Continue the course ½ mile past the islets, and then steer 221° true (S by W ¼ W mag.), and pass in mid-channel westward of the islands near the southern shore. Then steer about 269° true (SW by W ½ W mag.), and keep the northern shore aboard distant about 150 yards in entering North Arm. Anchor in the middle of the broad part of the arm in 9 to 11 fathoms.

Foul ground extends ½ mile southeastward from the northern point in the approach to Bay of Isles. At the end of the foul ground is a rock with 10 feet over it, lying ⅞ mile 73° true (NE mag.) from an island near the northern shore. The tangent to the shore southward of Bay of Isles in line with the eastern shore of Knight Island southward of Snug Harbor, bearing 197° true (S by E mag.), leads eastward of the foul ground.

Manning Rocks lie about 2 miles off the entrance of Bay of Isles. They are three pinnacles, with depths of 5, 9, and 23 feet on the south, middle, and north one, respectively, the distance between the end

ones being ⅞ mile. They are surrounded by deep water, and are the worst danger on the east side of Knight Island. Between Manning Rocks and the foul ground in the entrance of Bay of Isles the bottom is very irregular, although the least depth found is 8½ fathoms; this area should be avoided by vessels.

Marsha Bay, 4½ miles southward of Bay of Isles, has a crooked narrow entrance, and is suitable only for small craft. The depths are great except at its north end, where anchorage can be selected in 15 fathoms or less. The entrance is between two sunken rocks, and the channel then leads southward of the islands which choke the mouth of the bay. Enter in mid-channel between the outer island and the south point of the bay on a 252° true (SW mag.) course, and then favor the south point of the islands when passing through the narrowest part of the channel.

Snug Harbor is on the east side of Knight Island 6 to 7 miles northward of Point Helen. Its western arm is ¼ mile wide and clear near mid-channel, and is a secure anchorage at its head in 12 to 17 fathoms. Anchorage, exposed to northerly and northeasterly winds, can be had in the broad cove on the south side in the entrance of the harbor in 12 to 15 fathoms, rocky bottom.

Hogan Bay, on the east side of Knight Island 2½ miles northward of Point Helen, has anchorage in the middle, ⅝ mile inside the entrance, in 16 to 20 fathoms. The bottom is rocky and uneven, and the anchorage is exposed eastward. Small craft can pass through the narrow channel at the head of the bay and find secure anchorage in the inner cove in 12 fathoms or less. The spit on the southwest side of the channel is bold, and should be favored when entering the inner cove.

KNIGHT ISLAND PASSAGE,

on the west and south sides of Knight Island, is used by vessels calling at Drier and other bays on the west side of Knight Island. With easterly winds it offers a smoother channel from Latouche Passage to the northern end of the Naked Island group than the generally used route eastward of Knight Island.

From its northern entrance between Herring Point and Crafton Island, where it is 5 miles wide, it extends 16 miles in a 196° true (S by E mag.) direction to Pleiades Islands, with a least width of 2 miles at the southeast end of Chenega Island. The channel leads eastward of the Pleiades, where it is 1¼ miles wide between them and Point of Rocks. From these islands the passage has a 135° true (ESE ½ E mag.) direction for 10 miles, with widths of 3 to 4 miles, to Montague Strait between Point Helen and the north end of Latouche Island.

The depths in the passage range from 150 to 400 fathoms. The west side is generally bold, with the exception of the bight between Crafton Island and Point Nowell, which is foul. From Pleiades Islands to 5 miles southward of Herring Point the eastern shore is foul for ¾ mile off, many islands, rocks, and reefs being found in it.

There are no good anchorages in the bays on the west side of Knight Island. Small craft can anchor in nearly all the arms of the bays, but the bottom is generally rocky.

Main Bay, on the west shore southeastward of Port Nellie Juan, is deep and generally clear away from the shores, but affords no anchorage. Foul ground makes off the entrance points, especially from the northwest side, as shown on chart 8517.

Falls Bay affords no anchorage and is open to the prevailing northeasterly weather. The main body of the bay is clear and deep. Rocks make out from the points at the entrance, contracting it to a width of ¼ mile in which the least depth found is about 12 fathoms.

Crafton Island is 1 mile long and wooded. At its north end are rocky bluffs about 100 feet high, while its southern part is lower and has sandy beaches in places. Two low islets with sandy beaches lie off its south end.

Crafton Island is surrounded by foul ground to a distance of about ½ mile on its east and south sides, where no sounding has been done. An exceedingly broken area extends over 2 miles southeastward from the island; and a rock, bare at about half tide, lies 1 mile east-southeastward from the south end of the islands. Vessels should avoid all broken areas in this vicinity on which depths less than about 50 fathoms have been found.

The **passage westward of Crafton Island** is foul along the shore of the islands and at its south entrance. Three rocks bare at low water lie in the middle of the south entrance. This passage should be used only by small craft, proceeding with care and preferably at low water; the channel favors the west shore from the south entrance until abreast the middle of Crafton Island.

The clearer **channel to Eshamy Bay** follows the shore northward from Point Nowell and has a width of about ¾ mile. Differences in depth of 50 fathoms between adjacent soundings are not uncommon in this locality. Foul ground extends 350 yards northwestward, and rocky broken ground, on which the least depth found is 14 fathoms, extends ⅝ mile northward from the south point at the entrance of Eshamy Bay.

Eshamy Bay, at the head of the bight between Point Nowell and Crafton Island, affords no anchorage for vessels. Small craft can find secure anchorage, in 8 to 11 fathoms, in the small cove back of the islands and rocks in the southeast corner of the bay. The better entrance is through the middle of the deep, narrow channel between the small islands and the eastern shore. Eshamy Lagoon, with a saltery at its head, extends westward from Eshamy Bay, but its foul entrance with strong currents renders it not available for strangers.

Point Nowell, 4½ miles from Crafton Island, is a small wooded hook, about 50 feet high, back of which the land rises abruptly to about 1,600 feet. The cove on the south side of Point Nowell is about 300 yards in diameter and apparently clear, and affords anchorage for small craft in about 5 fathoms.

Dangerous Passage, on the west side of Chenega Island, has rocks bare at low water near mid-channel in its northern entrance, and appears foul.

Chenega Island, on the west side of Knight Island Passage, is 7 miles long and 1,800 to 2,000 feet high. Close to the north end of the island is a low, wooded island, with several islets on its northwest side. There is a prominent landslide at the south end of Chenega Island over the small Indian village of **Chenega**, and two low, wooded islets close to the shore off the village.

Herring Bay, at the northwest end of Knight Island, is 4 miles long from Herring Point to the head of its southeast and south arms, and 1 to 2 miles wide except in the arms. The bay has no desirable anchorage, and is characterized by much foul ground and very broken bottom, with deep water extending close to the shores and dangers. Vessels navigating the bay should proceed with caution, especially in the vicinity of broken areas with depths less than about 20 fathoms, and preferably at low water. The entrance is clear except along the eastern shore, which is foul. A prominent rock about 4 feet high lies near the middle 1½ miles southeastward of Herring Point; the best channel to the upper part of the bay is eastward of the rock. Water can be obtained from a fall in the southeast arm.

Herring Point is the north end of a narrow ridge, about 1,000 feet high, forming the west side of Herring Bay.

Channel Rock, a prominent bare, black rock about 6 feet high, lies nearly 1 mile off the entrance of Lower Herring Bay, and is a good mark for Knight Island Passage. A rock bare at low water lies 1½ miles 25° true (N ¼ W mag.) from Channel Rock and ⅝ mile from the shore of Knight Island; from this rock southward the eastern side of Knight Island is very broken and foul, with deep water extending close to the dangers, as shown on the chart.

Lower Herring Bay is not an anchorage for vessels, and is suitable only for small craft. The best entrance is eastward of Channel Rock, avoiding the rocky patch with depths of 17 to 22 fathoms lying between Channel Rock and the south point of the bay. The principal danger in the bay is a rock bare at three-quarters ebb which lies in the middle 600 yards from the eastern end of the bay. The passage between this rock and the point northward (lying between the two arms) should be used with caution. A midchannel course should be followed in the arms. Small craft can anchor in the cove on the south side 1¼ miles inside the entrance of the bay, in not less than about 10 fathoms; water can be conveniently obtained in this cove from a fall.

A narrow deep passage, suitable for small craft, follows the shore inside the islands between Lower Herring and Johnson Bays. Strangers should take it at low water and exercise care.

Johnson Bay is suitable only for small craft; strangers should enter at low water only, and proceed with caution in the vicinity of all broken ground. There is a wooded island in the mouth of the bay. The entrance is northward of the island, is about 125 yards wide between reefs bare at low water, and the axis of the channel is about 125 yards from the north shore on a 125° true (E ⅝ S mag.) course. From Knight Island Passage a 98° true (ENE ¼ E mag.) course for the north point at the entrance in range with a pyramidal peak of black rock (2,090 feet high) above the head of the bay will lead between the outlying dangers to the entrance. Water can be obtained from a fall near the head.

Squirrel Island, 9½ miles southward of Herring Point and ½ mile from the eastern shore, is the northernmost of the islands extending 1½ miles northward of the entrance to Drier Bay. It is ⅝ mile long, 180 feet high, and wooded.

Drier Bay is described under a separate heading following.

Southward of Drier Bay there are two large islands on the east side of Knight Island Passage, separated from Knight Island by Long

Channel. Mummy Island is described under Drier Bay. **Squire Island**, the southern one, is 3 miles long and about 1,000 feet high. A ledge, bare at low water, lies ¼ mile southward from the south end of Squire Island. Two islands lie ¼ mile off the west side of Squire Island, and from these islands a large reef extends ⅜ mile westward to **Point of Rocks**, the latter awash at high water. The channel between Mummy and Squire Islands leading into Long Channel has rocky, broken bottom, and should be used with caution.

Long Channel is a deep inside passage for small craft from Drier Bay to the southern part of Knight Island Passage. It is 4½ miles long and the mid-channel is clear so far as known. The channel is generally ¼ to ⅜ mile wide, but narrows to 175 yards abreast Mummy Island and to 250 yards ¾ mile from the north end of Squire Island. A rock, covered at high water, lies in the northern entrance ¼ mile 88° true (NE by E ⅜ E mag.) from the north end of Mummy Island. The tidal currents have little velocity.

From southward, the mid-channel courses are 22° true (N ½ W mag.) for 1 mile, then 358° true (NNW ⅝ W mag.) for ¾ mile to the southern end of the narrowest part of the channel abreast Squire Island, then 10° true (N by W ⅝ W mag.) for 2 miles to the northern end of the narrowest part of the channel abreast Mummy Island, and then 30° true (N ¼ E mag.) into Drier Bay.

There is a large bay on the east side of Long Channel abreast the north end of Squire Island. Its entrance is very narrow and foul, and suitable only for small craft with local knowledge. The tidal currents have considerable velocity in the entrance.

Pleiades Islands, in the middle of Knight Island Passage, are a group of 7 wooded islands 1 mile long. The southernmost and largest is about 80 feet high.

Mummy Bay, in the south end of Knight Island 4 miles westward of Point Helen, is about 1 mile wide and 3½ miles long. It is deep and clear, but rocks extend ¼ mile from the head. Small vessels can anchor ½ mile from the head in 15 to 20 fathoms. The southern arm on the eastern side of the bay is clear and affords anchorage for small vessels in 12 to 15 fathoms. The northern arm on the eastern side is an anchorage for small craft.

Little Bay, on the south side of Knight Island, 1¾ miles westward of Point Helen, is 1 mile long, ½ mile wide, and clear so far as known. The depths are 13 to 18 fathoms rocky bottom, and it is a fair anchorage except with southerly winds.

Ice.—Considerable glacial ice was seen in the passage south of Pleiades Islands. It comes from westward between Point Countess and Chenega Island, and drifts eastward as far as Latouche Passage with the ebb.

The **tidal currents** in Knight Island Passage have a velocity of 1 to 2 knots at the strength of the large tides.

DIRECTIONS, KNIGHT ISLAND PASSAGE.

From a position 1½ miles west of Storey Island make good a 211° true (S ¼ W mag.) course for 21 miles, passing 1¼ miles off the west side of Herring Point and to a position 1 to 1¼ miles eastward of Point Nowell.

Then steer 196° true (S by E mag.) for Pleiades Islands with Lone Island astern; having stood 7 miles on this course, New Year Islands,

on the north side at the entrance to Drier Bay, should bear about 1½ miles on the port beam. Continue the 196° true (S by E mag.) course for 10½ miles from Point Nowell until 1¼ miles from Pleiades Islands and the south tangent of Chenega Island is abeam.

Then steer 169° true (SE ½ S mag.) for 2½ miles, passing midway between Point of Rocks and the Pleiades. When the southeast end of Squire Island is 1 mile on the port beam, steer 146° true (SE by E ½ E mag.) with the north end of Pleiades Islands astern. This course made good for 7 miles will lead 1¼ miles off the southern shore of the passage and to the north entrance to Latouche Passage, and the course made good for 10 miles will lead into Montague Strait.

DRIER BAY

has its main entrance between Mummy Island and New Year Islands on the west side of Knight Island 11½ miles southward of Herring Point and 4½ miles northward of Pleiades Islands. The bay is 5 miles long in a northeasterly direction and nearly 1 mile wide. The southeast shore is indented by a number of bays and coves and by Long Channel.

The principal known dangers in the bay are mentioned in the following description. In addition, the entire bay and approach are characterized by exceedingly broken bottom, and vessels should proceed with caution in the vicinity of such areas where abrupt changes in depth are shown by the chart to depths less than 50 fathoms.

Mummy Island, on the south side at the entrance, is 1½ miles long, 543 feet high, and wooded; there are patches of grass on the southern half of the island. Reefs extend ¼ mile southwestward from the northwest end of the island, and wooded islets with reefs around them extend ⅝ mile westward from the southern half of the island. A rock covered at high water lies ¼ mile 88° true (NE by E ⅜ E mag.) from the north end of the island, but is in the way only when using Long Channel. A rock with 4 fathoms over it lies ¼ mile 64° true (NE ¾ N mag.) from the north end of Mummy Island.

New Year Islands are the southernmost of the islands which extend 1⅝ miles northward from the entrance to Drier Bay. They are about ⅜ mile long, wooded, and the southern and largest one 200 feet high. Bare reefs extend 250 yards southward of the south island. A rock bare at low water lies ¼ mile 19° true (N ¾ W mag.) from the north island, and is a serious danger in the channel between New Year Islands and the islands northward.

Clam Islands, two in number, low and wooded, lie between New Year Islands and the north point of the bay. A rocky patch with 3¾ fathoms over it lies 600 yards 191° true (S by E ½ E mag.) from Clam Islands, and nearly ¾ mile 102° true (ENE ⅝ E mag.) from the south end of New Year Islands.

Range Isle, small and wooded, lies close to the north side of the bay and 2 miles inside New Year Islands. The line of Range Isle just clear of the north shore eastward of it, bearing 75° true (NE ¼ E mag.), leads about through the middle of the entrance between Mummy Island and New Year Islands, and is sometimes used as a range for entering the bay.

Cathead Bay, on the south side 2 miles from Mummy Island, is 1 mile long and ¼ to ⅜ mile wide. There are two islands in the upper part of the bay. The soundings taken indicate deep water, but it is not thoroughly developed. In the entrance of the bay 200 yards from the west side is a rock with 4 feet over it. Also off the entrance, ¼ mile 50° true (NNE mag.) from Cat Head and ⅝ mile 191° true (S by E ½ E mag.) from Range Isle, is a rock with 3½ fathoms over it. When entering favor the east side to avoid these rocks and then proceed with caution on either side of the islands to its head.

Mallard Bay, on the south side, 2½ miles inside Mummy Island, is 1 mile long and ⅜ to ½ mile wide. The bay is foul for a distance of ¼ mile from its head. Approaching with care, anchorage can be made ⅜ to ½ mile from the head in 17 to 20 fathoms.

Barnes Cove, 4 miles inside Mummy Island and 135° true (ESE ½ E mag.) from Chase Island, is obstructed by ledges at its entrance, and shoals make out from the shores of the cove. Small craft entering with care can find good anchorage in 8 fathoms. Vessels can anchor 300 to 500 yards off the entrance in 20 to 22 fathoms.

The point on the northeast side of Barnes Cove is prominent and high, with bare rocky sides. A reef extends 150 yards off the small point ⅜ mile northeastward of this point.

Chase Island, small and wooded, lies 700 yards from the northwest side of the bay and 1¾ miles above Range Isle. A ledge bare at low water extends 300 yards southward from Chase Island.

A rock awash at half tide lies ⅜ mile 61° true (NE by N mag.) from Chase Island. It is sometimes marked by a buoy. There is a rock bare at extreme low water between the half-tide rock and the northern shore.

Northeast Cove, on the southeast side at the head of the bay, is small and has shoals at its entrance and also inside for 200 yards from its head. Small craft entering with care can find good anchorage in 4 to 5 fathoms. Vessels can anchor 300 to 500 yards off the entrance in 17 to 20 fathoms.

Anchorage can be selected about ¼ mile from shore in the north end of the bay, in about 20 fathoms.

At the north end of the bay is the narrow entrance to a lagoon which affords good anchorage for small craft in 6 to 10 fathoms. There is 7 feet in the narrow entrance; a flat extends 250 yards from the head. A sunken rock lies in the approach 50 yards from the eastern shore and 100 yards southeastward from the narrow entrance.

DIRECTIONS, DRIER BAY.

Strangers may have some difficulty in recognizing the entrance to Drier Bay, as there are several groups of islands on the east side of Knight Island Passage, both north and south of the entrance. Approaching from northward the island in the mouth of Johnson Bay is a good mark.

From northward, follow the directions for Knight Island Passage, and when 7 miles past Point Nowell the position should be midway between New Year Islands and the south end of a sand beach on Chenega Island. Then steer 129° true (E by S mag.) for the north end of Mummy Island and pass about ⅜ mile southward of the bare

rocks off the south end of New Year Islands. When New Year Islands are a little abaft the beam, steer 84° true (NE by E mag.) and pass about ⅜ mile northward of Mummy Island into the bay.

From southward, steer 16° true (N by W mag.) with Pleiades Islands astern until about 1 mile past the southeast point of Chenega Island. Then steer 64° true (NE ¾ N mag.) with the southeast point of Chenega Island astern, and pass about ⅜ mile northward of Mummy Island.

Entering about midway between Mummy Island and the bare rocks southward of New Year Islands, steer 84° true (NE by E mag.) for 3¼ miles, passing ¼ mile southward of Range Isle. When 400 yards from the southeast shore above Mallard Bay, steer 50° true (NNE mag.), passing about 600 yards southeastward of Chase Island and about 400 yards off the southeast shore above the island. Then keep near the middle of the bay.

MONTAGUE STRAIT,

between Montague and Latouche Islands, is the broadest of the passages westward of Montague Island, and passing westward of Green Island offers a clear channel 4½ miles wide from Prince William Sound to the sea. It is, however, rarely used, vessels generally passing through Latouche and Elrington Passages. The **passage between Green and Montague Islands** has considerable foul ground and should be avoided by strangers in the absence of a survey.

From a position 1 mile westward of Seal Island a 203° true (S ⅜ E mag.) course made good for 42 miles will lead 1 mile off the eastern shore of Latouche Island, 1½ miles off the western shore of Montague Island near its southern end, and to a position about 2⅜ miles westward of Cape Cleare.

Or, having made good the 203° true (S ⅜ E mag.) course for 30 miles to a position 1 mile off the eastern shore of Latouche Island 5½ miles from Point Grace, steer 230° true (SSW mag.) for 8 miles to a position 2 miles southeastward from Danger Island. From this position a course can be shaped as desired. (See bearings and distances from Danger Island, on p. 66.)

Green Island is wooded, about 6 miles long, 520 feet high near its middle, and slopes gradually to its north and south ends. The vicinity of the island is very foul. Two wooded islets and numerous small ones lie close to the northwest side of the northeastern half of the island. Three prominent rocks 10 to 15 feet high lie 1 to 1¼ miles off the northwest and west sides, the southwesternmost lying 1 mile southwestward from the western end of the island.

An extensive reef, marked by kelp, lies midway between Green Island and Seal Island. It is apparently a ridge having a northerly direction for 2½ miles, with bare rocks (about 3 feet high) at its north end, and numerous sunken rocks and others which show at extreme low water. The northern bare rock lies 3¾ miles southeastward from Seal Island, with deep water between. Between the reef and Green Island there is broken ground on which the least depth found is 10 fathoms, but the area has not been completely surveyed and should be avoided by vessels.

Gibbon Anchorage is a secure harbor for small craft in the cove about the middle of the northwest side of Green Island. Passing

600 yards southward of the outlying prominent rock which lies 1⅜ miles westward of the cove, steer 126° true (E ¾ S mag.) for Putnam Point, the prominent wooded point with a small bluff on the southwest side of the cove. When about ¼ mile from shore, steer more eastward and pass nothing southward of midway between Putnam Point and the rock awash at high water which lies 400 yards northward of the point. When past the rock, anchor in the cove eastsoutheastward of it, in 6 to 8 fathoms. A rock awash at half tide lies 175 yards north-northeastward of the point lying ¼ mile west-southwestward of Putnam Point; and the southerly one of two rocks, bare at extreme low water, lies ⅝ mile 133° true (ESE ⅝ E mag.) of the outlying bare rock.

A low, wooded island ½ mile long lies 1⅛ miles southward from the south end of Green Island. A large reef, partly bare at low water, lies ⅜ to 1⅛ miles south-southwestward from the south end of the low, wooded island.

The Needle is a flat-topped, steep-sided rock, about 75 feet high, in the strait 3¾ miles from the nearest point of Montague Island and 5½ miles eastward from Point Helen.

Hanning Bay is on the east side of the strait, 13 miles northward of Cape Cleare and 151° true (SE by E mag.) from the north end of Latouche Island. It is a good anchorage with easterly winds, but is exposed from northwest, through west, to southwest. It is about 2 miles in diameter, with depths from 7 to 22 fathoms. Shoals extend nearly ⅜ mile off from the streams at the northeast and southeast ends of the bay, and a reef extends nearly ¼ mile from the point on the eastern side. The best anchorage with southerly winds is about ⅜ mile from the south side, with Danger Island open from the south point at the entrance bearing 258° true (SW ½ W mag.), and the north point at the entrance bearing between 5° true (NNW mag.) and 348° true (NW ½ N mag.), in 15 to 16 fathoms, sticky bottom. With northwest winds, a better berth can be had ¼ to ⅜ mile off the cove on the north side, ⅝ mile inside the entrance, in 5 to 8 fathoms, hard bottom. When entering, give the points at the entrance a berth of over ⅜ mile.

Macleod Harbor, on the east side of the strait, 6½ miles northward of Cape Cleare, is not surveyed. It is 1½ miles wide at the entrance and possibly 2 miles long. The following information is from reports: Vessels can anchor in 13 to 14 fathoms about ½ mile off the sand beach on the south side in the lower part of the bay, but it is more exposed to the ocean swell than Hanning Bay. The depths at the entrance are 7 to 8 fathoms, and in the bay 12 to 21 fathoms. There is a dangerous flat on the eastern and southeastern sides of the bay. There is good anchorage for small craft and possibly very small vessels in a cove on the north side toward the head. The cove is formed by a point which is bold and should be kept aboard. The anchorage is with the south point of the harbor shut in by this point, about 200 yards from the latter, in 4½ fathoms.

Latouche Island is 10 miles long and has elevations up to 2,255 feet. It is wooded to an elevation of about 500 feet, and above this is covered with moss and bushes, except the highest peaks, which are bare rocks. The eastern shore is precipitous and the 100-fathom curve less than ¼ mile off in places.

Danger Island, 1⅜ miles southward of Latouche Island, is ⅜ mile in diameter, low and wooded. The island is surrounded by bare rocks and kelp to a distance of ⅝ mile northward and southward of it, and ¼ mile eastward and westward. Eastward of the island the foul ground is not developed. There is no safe passage between it and Latouche Island. A bar with depths of 6 to 11 fathoms extends west-northwestward from Danger Island to Elrington Island. A depth of 3½ fathoms is found on it ⅜ mile westward of Danger Island, and 3¾ fathoms 700 yards from Elrington Island and 308° true (W by N mag.) from Danger Island. The following are bearings and distances from Danger Island:

Barwell Island, off Cape Resurrection, 264° true (SW by W ⅛ W mag.), 36½ miles.

Lone Rock, south end of Chiswell Islands, 246° true (SW ½ S mag.), 51 miles.

Seal Rocks, 242° true (SW ⅞ S mag.), 53 miles.

LATOUCHE AND ELRINGTON PASSAGES,

between Latouche and Hoodoo Islands, are generally used by vessels between Prince William Sound and the coast southwestward, passing westward of Elrington Island. There is also considerable traffic to the wharves of the copper mines on the west side of Latouche Island.

From Point Grace to the north end of Elrington Island, a distance of 5 miles, **Latouche Passage** is about 1¾ miles wide, with deep water. There is a wooded islet, with a grass-covered rock close to its north end, near Hoodoo Island ¾ mile northwestward of the northern entrance.

Latouche Passage, east of Elrington Island, is 7 miles long and ¾ to 1 mile wide, with moderate depths, under 30 fathoms in most places. Anchorage can be selected nearly anywhere in this channel where the depth is suitable. At the south end the least depths found are 6 to 11 fathoms on the bar between Danger and Elrington Islands.

A little southward of the former Barrack's Wharf, nearly 2 miles southward of Point Grace, a reef makes out over 100 yards from shore; it is sometimes marked by a barrel buoy.

Latouche, a post office on the west side of Latouche Island 2¼ miles southward of Point Grace, has a store, and is the site of the mine of the Beatson Copper Co.

The new wharf at Latouche has a depth of about 20 feet at its end, and is about 200 feet long on its face. There is a rock about 100 feet northward of the wharf and on the line of its face. Vessels generally go to the wharf port side to, heading southward, and to leave the wharf swing the bow in toward the shore and back into the passage. There is a tramroad to the mine about ½ mile southeastward, and considerable copper ore is shipped. The cove southward of the wharf is shoal, and a reef makes out about 100 yards from the point 400 yards southwestward of the wharf. Anchorage can be had 300 to 500 yards west-northwestward from the wharf in 10 to 15 fathoms.

Chicken Island, 3½ miles southward from Point Grace, is the northern one of two small wooded islands, 2½ miles apart, on the east side of Latouche Passage. It is separated from Latouche Island by a pass 350 yards wide with a depth of 4 feet. A rock with 15 feet over

it lies 300 yards off the point on the eastern shore ⅝ mile northward from Chicken Island.

Horseshoe Bay is on the west side of Latouche Island, 4½ miles southward of Point Grace. Its southern half is shoal; small craft or a very small vessel, entering close to the north point of the bay, can anchor in its north end in 18 to 20 feet of water. Just northward of the south point of the bay is a rock, covered at high water. Vessels can anchor about ¼ mile off the entrance, in 16 to 18 fathoms.

From a little southward of Horseshoe Bay to the southern island in Latouche Passage the eastern side has broken ground and kelp in places, and should be given a berth of ⅜ mile. The passage eastward of the southern island is ¼ mile wide, with much kelp, and should be avoided by vessels.

On the west side of Latouche Passage is a long bay separated from Elrington Passage by several high, wooded islands. The bay has deep water but is not thoroughly developed. At the southwest end of the bay is a cascade, which shows from Latouche Passage.

Elrington Passage, on the west side of Elrington Island, is 8 miles long, ½ to 1 mile wide, deep and clear. Anchorage is not easily found on account of the great depths.

A grass-covered rock, about 10 feet high and with some brush on its summit, lies close to the west side of Elrington Island 4 miles from its north end.

In the southeast angle of the passage 1⅜ miles southward of this rock there is anchorage in 5 to 20 fathoms, muddy bottom, depending on the swinging room required.

An island ⅝ mile in diameter and 500 feet high lies in the bend at the south end of the passage close to Elrington Island, from which its southeast point is separated by a narrow pass dry at low water.

A pyramidal, pinnacle rock, about 8 feet high and with grass on top, lies about 250 yards off the north point at the southwest entrance of Elrington Passage.

Procession Rocks, near the south end of Bainbridge Island, 3¼ miles westward of the southwest entrance of Elrington Passage, are a good mark. They are a small cluster of rugged rocks, the three largest about 35 feet high.

Elrington Island, which divides Latouche Passage from Elrington Passage, is 10 miles long, about 1 mile wide, and has a greatest elevation of 1,967 feet. The general tree line is about 500 feet high, and the higher peaks are precipitous and bare. The southwest end of the island is 2½ miles across in a northerly and southerly direction and is formed by three high, prominent points with two long bays between. Both bays are clear and afford anchorage. The southern one has the best shelter, with depths from 17 to 20 fathoms, but is exposed to southwesterly and westerly winds.

Point Elrington, the southwest end of Elrington Island, is a small hill, 515 feet high and wooded, with cliffs at the water, and is joined to the island by a sand and gravel neck just above high water. A hill, 1,050 feet high, lying 1⅜ miles eastward of the point, has a low divide about 100 feet high at its east end. It is marked at its westerly end by Point Elrington light.

The north point at the southwest end of Elrington Island is a hill 1,116 feet high and 1⅜ miles long. At its southeast end it is connected with the island by a long, low, wooded neck.

DIRECTIONS, LATOUCHE AND ELRINGTON PASSAGES.

To go through Latouche Passage.—From a position ¾ to 1 mile eastward of Point Helen light steer 230° true (SSW mag.) for 5 miles to a position with Point Grace on the port beam distant ¾ to 1 mile. Then steer 221° true (S by W ⅛ W mag.) for 6 miles to a mid-channel position abreast the southern island in Latouche Passage. Then steer 207° true (S mag.) for 2 miles, following the western shore at a distance of about ⅜ mile. Then bring the southern island in Latouche Passage open half its width westward of Chicken Island, and steer out of the passage on this line, course 220° true (S by W ⅛ W mag.) for about 4 miles, which leads in the deepest water (about 11 fathoms) over the bar between Danger and Elrington islands.

To go through Elrington Passage.—From a position ¾ to 1 mile eastward of Point Helen light steer 230° true (SSW mag.) for 9¼ miles, passing about ¾ mile off the western shore of Latouche Island and to a position ⅜ mile eastward of Bettles Island. When Elrington Passage light opens southward of Bettles Island, change course gradually to about 263° true (SW by W mag.) and pass in mid-channel between Bettles Island and the north end of Elrington Island.

When ¼ mile westward of Elrington Island steer 219° true (S by W mag.) in mid-channel for 4¼ miles, with Elrington Passage light astern. When Lone Tree Point light opens from the south end of Hoodoo Island, haul gradually westward, pass in mid-channel southward of Hoodoo Island, steer 286° true (W by S mag.), and pass about ⅜ mile northward of Lone Tree Point light. Round the south point at the entrance at a distance of about ½ mile and steer 229° true (S by W ⅞ W mag.) about 8 miles to a position 3 miles 168° true (SE ½ S mag.) from Cape Puget. From this position the courses and distances to Resurrection Bay and Seal Rocks are given on page 26.

PRINCE OF WALES PASSAGE,

between Hoodoo and Bainbridge Islands, is between 10 and 11 miles long and from ½ to 2 miles wide. It offers a direct route for vessels from northward in Knight Island Passage bound southwestward along the coast; otherwise Elrington Passage is more direct and is generally used.

Prince of Wales Passage has a number of dangers and other broken ground, but no trouble should be had in going through it in daylight and clear weather, with the aid of the chart. The principal channel is eastward of Flemming Island, and then westward of the group of bare rocks lying 1½ miles south-southeastward of Flemming Island. When passing the broken ground lying 4 miles southward of Flemming Island, follow the western shore at a distance of 300 to 500 yards, heading for the prominent low, sandy point, with a fringe of trees, lying on the west side 3 miles farther southward.

Prince of Wales Passage has no anchorage for vessels. Small craft can find shelter at the head of Shelter Bay, on the east side at the head of the bay 1½ miles southeastward of Flemming Island, in the lagoon on the east side nearly 3 miles southward of Flemming Island, and in the coves on the east side 6 and 8 miles southward of Flemming Island. Considerable swell makes into the last-named cove during southerly winds.

Flemming Island, over 2 miles long and 845 feet high, lies in the northern end of the passage. The channel westward of Flemming Island has considerable foul ground, and should be avoided by strangers, except possibly small craft, at low water, and proceeding with caution.

The wooded island, with a group of partly bare rocks off its south side, which lies in Knight Island Passage ½ mile northward of Flemming Island, is a good mark for the north entrance of Prince of Wales Passage.

Ship Islet, with a few trees, is the southerly one of two on the easterly side of Flemming Island. A reef bare at low water extends 225 yards southeastward from it.

A group of bare rocks (highest about 3 feet) lies ⅜ to ½ mile from the eastern shore and 1½ miles south-southeastward of Flemming Island.

About 1 mile south-southeastward of these rocks is a lagoon with a narrow entrance almost closed with rocks. It is a secure harbor for small, light-draft craft, in about 8 fathoms, but the entrance requires local knowledge.

There are several wooded islands on the east side of the passage from 3 to 5 miles southward of Flemming Island. The area between them and Hoodoo Island is foul, and the tidal currents have a velocity of 2 to 3 knots.

Nearly in mid-channel westward of the middle of these islands is an area of broken ground nearly ½ mile long on which the least depth found is 11 fathoms. It should be avoided by vessels, the better channel following the western shore.

The broken area with depths less than 15 fathoms, lying 1 mile farther southward, which extends ¼ mile from the western shore, should be avoided by vessels.

Currents.—With the large tides the tidal currents have a velocity of 2 to 3 knots at strength among the islands and in the narrower parts of the passage. In the passage between Flemming and Hoodoo Islands the tidal currents have a velocity of 1½ to 2 knots at strength. The flood current sets northward and ebb southward through the passage.

KENAI PENINSULA, SOUTH COAST.

CAPE PUGET TO CAPE RESURRECTION.

This coast is high and rugged, with numerous glaciers showing in the valleys. The prominent headlands are fairly well located, but the bays are sketched and no information about them is available. There are no outlying dangers along the coast so far as known.

Cape Puget is a high, sloping headland, and there are several bare rocks off it, the farthest about ⅜ mile. Rocks about 30 feet high lie off its eastern side well northward of the cape. From alongshore eastward or westward the cape shows a wooded peak at the end, with a large conical rock in the water close to its foot.

Cape Junken is high and has two steps near the water at its end as seen from alongshore.

At the head of **Johnstone Bay**, 5 miles westward of Cape Junken, there is a large, prominent glacier which comes down to high-water mark.

Cape Fairfield, on the west side of Johnstone Bay is a high, sloping headland, with an immense pinnacle shaped like a shark's tooth at its foot. As seen from southwestward there are two smaller pinnacles on either side of it.

There is a large glacier at the head of the eastern arm of Day Harbor.

Cape Resurrection is a precipitous headland of solid rock, with little vegetation except some trees on the lower slopes. From eastward two dome-shaped peaks, the north one the higher, with a slight notch between them, show at the end of the cape, with a somewhat lower ridge back of them, but rising to higher mountains farther north. **Barwell Island**, ⅜ mile southeastward of Cape Resurrection, is small, bare, rounded, precipitous, and 475 feet high.

RESURRECTION BAY

is about 16 miles long from Cape Resurrection. The depths are great throughout, and there are no dangers in the usual track of vessels. A flat extends ½ to ⅝ mile from the entire northern shore at the head of the bay. The shores and islands are steep and high, with precipitous slopes in many places. The valleys are wooded up to an elevation of about 1,000 feet. The anchorages are few and indifferent on account of the great depths, and are subject to heavy williwaws.

Seal Rocks, the southernmost point in the approach to the bay, are a group of four small, rocky islets. The northernmost and largest is 278 feet high and has an arch through the middle. The following are bearings and distances from Seal Rocks:

Cape Puget, 55° true (NNE ½ E mag.), 44 miles.
Point Elrington, 59° true (NNE ⅞ E mag.), 49 miles.
Danger Island, 63° true (NE ⅞ N mag.), 53 miles.
Cape Cleare, 75° true (NE ¼ E mag.), 55 miles.
Marmot Island (southeast point), 220° true (S by W ¼ W mag.), 105 miles.
Pye Island Reef, 243° true (SW ⅝ S mag.), 27 miles.

Lone Rock stands well southwestward of Chiswell Islands and is a good mark. It is a round rock, 154 feet high, and there is a rock covered at high water about ¼ mile northward of it. The passage between Seal Rocks and Lone Rock is clear and is frequently used by vessels between Resurrection Bay and the coast southwestward.

Chiswell Islands are a group of numerous, high, precipitous, rocky islands, the southeasterly ones of those lying in the entrance of Aialik Bay. The islands are sparsely wooded, most of them have off-lying rocks, and there are strong tidal currents between them.

Pilot Rock, lying 1¼ miles from the nearest point on the western shore of Resurrection Bay, is a bare, rounded, rocky islet about 100 feet high, and is marked by a light.

Bear Glacier, large and prominent, is on the western shore westward of Cape Resurrection. It is not discharging.

Toward the eastern shore in the entrance of Resurrection Bay are three large, high, rugged islands, named in order from southward **Rugged**, **Hive**, and **Renard**. The passages through the islands are deep. Their shores are generally bold, but two rocks bare at low water lie 200 yards southward from the southeast end of Renard Island. Rugged Island is marked on its northeast side by a light.

Sunny Cove, the southern bight on the west side of Renard Island, is the best anchorage in Resurrection Bay. No ocean swell makes into the cove, and it is sheltered from all but westerly winds. The williwaws are bad with easterly winds. The cove is ⅜ to ½ mile wide and clear. The anchorage is in the middle, 300 to 800 yards from its head, in 15 to 25 fathoms, muddy bottom.

Small craft can anchor in the southeast arm of the bight on the eastern shore 1½ miles northward of Renard Island.

Caines Head is the projecting and prominent, precipitous, high headland on the western shore 2¾ miles above Renard Island. It is marked by a light.

Thumb Cove, on the eastern shore northeastward from Caines Head, is ¾ mile wide and 1½ miles long. Anchorage can be selected ⅜ to ½ mile from the head, in 25 to 30 fathoms, soft bottom. A flat makes out 200 to 300 yards from the northern shore for a distance of ⅜ mile from the head.

Seward is an important town on the western side at the head of Resurrection Bay. There are stores and hotels, and provisions and supplies of most kinds can be obtained. There is cable communication with other points in Alaska and Seattle. From Seward a railroad has been constructed across Kenai Peninsula to the head of Turnagain Arm, and its construction is at present being continued toward the Matanuska coal fields and Fairbanks. There is communication by telephone and telegraph to points in the interior along the line of the road. The wharf is off the southern front of the town, and has a depth of 30 feet or more along its southern face. Fresh water can be had at the wharf through pipe and hose. With strong southeast winds vessels can not lie at the wharf. There is a blacksmith and machine shop. Coal in small quantities is kept on hand.

The only **anchorage** near the town is 300 to 400 yards off the railroad water tanks, about ½ mile northward of the wharf, in 20 fathoms, soft bottom, with scant swinging room. This anchorage is exposed to southeast winds, and with offshore winds vessels are liable to drag off into deep water on account of the steep pitch of the bottom.

There are depths of 20 to 30 fathoms in the bight between Lowell Point and Tonsina Creek, except near the point, where the depths are greater.

Tides.—At Seward high and low water occur about 46 minutes earlier than at Kodiak, and the mean rise and fall of the tides is 8.4 feet. To find the height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.21.

DIRECTIONS, RESURRECTION BAY.

From eastward.—From a position 1 mile 173° true (SE by S mag.) from Barwell Island steer 319° true (WNW mag.) for 5 miles, passing ½ mile southwestward of Barwell Island and midway between Hive and Renard Islands. When ½ mile off the southwest end of Renard Island steer 4° true (NNW mag.) for 5½ miles to a position ½ mile off the northeast side of Caines Head. From this position a 342° true (NW mag.) course for 6¾ miles will lead to Seward.

From southward.—Seal Rocks are high, have deep water around them, and are the best mark for which to shape the course. See also the remarks under Aialik Bay relating to the route occasionally used by small vessels passing northward of the islands in its entrance.

Pass about 2 miles eastward of Seal Rocks and steer 15° true (N by W mag.) for 14 miles, passing about 1½ miles eastward of Chiswell Islands and to a position 1 mile eastward of Pilot Rock light. Then steer 2° true (NNW ¼ W mag.) for 6¾ miles to a position ½ mile off the southwest point of Rugged Island. Then steer 13° true (N by W ¼ W mag.) for 8½ miles to a position ½ mile off the northeast side of Caines Head. From this position a 342° true (NW mag.) course for 6¾ miles will lead to Seward.

Or, for vessels going inside of Seal Rocks, pass 1 to 1½ miles northwestward of Seal Rocks and steer 56° true (NNE ⅝ E mag.) for 4½ miles until the easternmost of the Chiswell Islands bears on the port beam distant 1½ to 2 miles. Then steer 15° true (N by W mag.) for 10 miles to a position 1 mile eastward of Pilot Rock, as in the preceding paragraph.

AIALIK BAY

is 16 miles long from the north end of Harbor Island. It is inclosed by rugged mountains and glaciers and is of no importance except occasionally as an anchorage. The shores are steep and high, with precipitous slopes in many places, and are partly wooded in the southern part of the bay to an elevation of about 1,000 feet. The northern part of the bay is covered with alders in places.

Aialik Bay has deep water with the exception of rocks near the shores, and a bar which crosses the bay from the glacial flat fronting Pederson Glacier. The least depth found on this bar near the middle of the bay is 18 feet, but it and the broken ground near the shores at the entrance of Holgate Arm are liable to have bowlders and less water than charted. As a measure of caution vessels should avoid the passages among the islands in the mouth of the bay.

To take advantage of smoother water, small vessels in coasting southwestward from Resurrection Bay, and the reverse, sometimes enter the bay at **Aialik Cape**, pass south of Chat Island, round the north end of Harbor Island, and pass out at Granite Cape. From a position 1 mile east-southeastward of Granite Cape a 226° true (S by W ¾ W mag.) course for 26 miles will lead to a position 3½ miles 155° true (SE ½ E mag.) from the peak of the outer Pye Island.

Chat Island is a steep, rocky, wooded island, 470 feet high; two conspicuous pinnacles lie close to its south shore. Between it and Aialik Cape are a smaller island and a number of rocks.

Harbor Island is the largest of a group of high, precipitous, rocky, partly wooded islands, lying in the mouth of the bay and northwest of Chiswell Islands. The shore in many places is a sheer cliff, especially the east shore of the eastern and highest island. Lying midway in the channel between the northern, beehive-shaped Chiswell Island and the small island at the southeast end of the Harbor Island group is a rock which is bare at lowest tides.

Granite Island is a partially wooded, steep, precipitous island, 1,570 feet high. **Granite Cape**, at its southeast end, has a rock which covers at high water about 80 yards off.

Between Granite Cape and the main shore are two small wooded islands about 200 feet high with a rock about 10 feet high between them.

Twin Islands resemble each other in contour and are 400 and 550 feet high. They are wooded, and the arch off the south end of the northern island is conspicuous.

Anchorages.—The anchorages are few and indifferent due to the great depth. With southerly weather a swell makes well into the bay.

The best anchorage is near the head of the middle arm of the three arm bay on the east side of Aialik Bay, about 3 miles north of Harbor Island, in 30 fathoms, good holding bottom.

Anchorage can be had in the cove on the west side of the bay, westward (true) of the north end of Harbor Island. The anchorage is in 28 fathoms near the center of the cove. On each side of the entrance to this cove is a sharp, conical, wooded hill about 800 feet high. Close inshore off the point at the north entrance is a sharp pinnacle rock about 25 feet high; about 600 yards northeastward of this pinnacle is a rock which covers at about half tide.

There is fair anchorage off the small bight which lies on the east side 1¼ miles southward of the bar crossing the bay. Anchor in 22 to 25 fathoms off the middle of the bight and a little outside of the line joining the two points forming the bight. The bight may be recognized by a hanging glacier at its head.

Ice.—There are discharging glaciers at the head of Aialik Bay and Holgate Arm, and ice is frequently driven to Harbor Island by northerly winds. Holgate Arm and the entire bay above the bar are frequently filled with ice.

NUKA BAY

lies between Pye Islands and Nuka Island; the outer part is about 8 miles long and 5 miles wide, and there are two main arms at its head. There are several bays and coves affording anchorage. The bay is not surveyed, but soundings through the middle indicate very deep water, as shown on the chart.

Pye Islands, on the east side at the entrance of Nuka Bay, are three rugged, mountainous islands having a total length of 7½ miles. The highest peak of the outer island is near its eastern end, and is a good mark. Approaching from northeastward the break between the outer and second islands shows well. From southwestward the separate islands do not show, but at the eastern end is seen the highest peak, from which there is a slope to a high shelf at the water. There are breakers in places along the eastern side of the islands, the southernmost lying ⅜ or ½ mile eastward from the eastern end of the outer island.

Pye Island Reef, awash or barely covered at high water, lies 2⅜ miles 206° true (S mag.) from the peak of the outer Pye Island. There is always a break on the reef, but at high water with an exceptionally smooth sea there may be some interval between them. Depths of 18 to 60 fathoms were found about midway between it and the island. The line of the western ends of the outer and second islands leads a little westward of the reef, and the line of the eastern ends of the outer and third islands leads well eastward of it.

The channel between the second and third Pye Islands has a kelp patch in its western entrance a little southward of mid-channel, and the eastern entrance is obstructed by breakers.

McArthur Pass, between the third Pye Island and the mainland, is about 100 yards wide in its narrowest part for a distance of about 200 yards. A least depth of 7 fathoms was found in mid-channel, and the tidal current had a velocity of 4 to 5 knots southwestward through the pass near the time of low water. It is not recommended except for small vessels at slack water.

The **east arm of Nuka Bay** lies at the western entrance of McArthur Pass. It is about 2 miles wide at the entrance and 5 miles long. A large glacier comes down to high-water mark at its head, and frequently discharges some ice. No bottom at 20 fathoms was found through the middle, and no bottom at 35 fathoms was found about 100 yards or less from the bare spit at the foot of the glacier. Indifferent anchorage in 25 fathoms was found near the northern shore of the first cove northward of McArthur Pass on the east side of the arm.

Nuka Island, on the western side of Nuka Bay, is mountainous and about 8 miles long. At its southern end are two points; the southern one has the appearance of a large, high island, its outline being an arc of a circle, and is distinctive; the northwestern one is a high peak with a fairly regular slope to the water. Bare rocks show in the bight between these points and off the entrance. No information is available for Nuka Island Passage, westward of the island, and the eastern shore of the island should be given a good berth.

Palisade Bay, on the east side of the west arm of Nuka Bay, 9½ miles above outer Pye Island, will be known by a high, wooded island on the south side in its entrance. Anchorage can be had on the northeast side of the island, about on a line from its north end to the point on the main shore, in 14 to 20 fathoms. The cove on the southwest side of the island is foul.

Palisade Bay is about 3 miles long. Anchorage can be had about ⅓ mile from the narrow part at its head, in 17 fathoms, with ample swinging room. From the top of an adjacent mountain a sunken rock was seen between this anchorage and the northeast shore, but a search for it in a boat did not find it.

Cabin Bay, on the west side, opposite Palisade Bay, is about 2½ miles long. No bottom at 20 fathoms was found through the middle of the bay. A very small vessel anchored at its head in 13 fathoms. From the prominent point on the west shore southward of Cabin Bay a reef makes out about ¼ mile.

Rock Bay, on the east side of the west arm, 11½ miles above outer Pye Island, will be known by a cluster of wooded islets and bare rocks on the south side at its entrance. From the islets to the north point at the entrance is a bank, on which there is kelp for about 150 yards from the islets, and a reef extending one-third the distance across from the point. Entering in mid-channel or slightly favoring the islets, a depth of 9 fathoms will be found over the bank. Anchorage can be had toward the eastern shore in 14 fathoms. The course in is about 121° true (E ½ S mag.).

Shelter Cove, on the west side, 13½ miles above outer Pye Island, lies 236° true (SSW ¾ W mag.) from the point dividing the north and west branches at the head of the west arm. The cove is small,

but affords anchorage in the middle of its entrance, in 13 fathoms, with ample swinging room. At the head of the cove is a grassy flat, in front of which is a good sized mud flat that covers.

The point dividing the north and west branches at the head of the west arm has a small cluster of grass-covered rocks and wooded islets close-to.

The west branch is 1½ miles long, with deep water to the large mud flat at its head.

The north branch is 5 miles long in a 31° true (N ½ E mag.) direction and nearly 2 miles wide at the entrance, and has a depth of about 77 fathoms through the middle until abreast Pilot Harbor. There is a depth of 18 fathoms less than 50 yards from the low-water edge of the flat at its head. **Pilot Harbor,** on the eastern side of the north branch, 1 mile from its head, is a short bay having a 93° true (ENE mag.) direction. There is a large bare rock, about 3 feet high, off each point at the entrance. Entering in mid-channel, a secure anchorage will be found in the middle, or slightly favoring the south side, in 13 to 15 fathoms. There is a flat at the head, on the low-water edge of which is a wooded islet, lying about ¼ mile above the bare rock off the north point at the entrance.

POINT GORE

is a prominent headland lying 18 miles 247° true (SW ¼ S mag.) from Pye Island Reef and 16 miles 70° true (NE mag.) from the southeast end of East Chugach Island. From eastward and westward it shows as an island with a high peak near the middle and a broad, high shoulder at the ends, and separated from the high land northward by a narrow gap. There is an arch in the rocks at the eastern end of Point Gore, which shows over a small arc from southward, and a folding in the strata in the face of the cliff on the south side of the point.

The neck joining Point Gore to the mainland is low and wooded. Anchorage with shelter from southwest winds is reported toward the northwest shore off the east side of this neck in about 17 fathoms, but no description or definite information as to its exact location is available. It is wide open to all easterly winds, and vessels must be prepared to leave immediately when the swell begins to make around the point to the anchorage.

On the west side of the neck back of Point Gore is a cove affording indifferent anchorage with easterly winds. The south point of the cove is the northwest end of Point Gore, and is a shelving ridge of bare rock, from the end of which rocks, bare at low water, and kelp extend about 200 yards northwestward. A rock covered at high water lies about 100 yards from the cliff at the southeast end of the cove, and a large kelp field extends about 200 yards northwestward from the rock. The anchorage is in 18 to 25 fathoms, soft bottom, 250 to 300 yards from the beach of the low neck and from the edge of the kelp off the rock, and about ¼ mile from the cliff on the southern side. The water deepens rapidly northwestward, the swinging room is scant, and the anchorage is uneasy.

To enter, round the south point of the cove at a distance of ½ mile and steer 115° true (E mag.) for the gap in the trees, or lowest part of the neck.

PORT DICK,

on the west side of Point Gore, is about 2½ miles wide at the entrance and has a 357° true (NNW ½ W mag.) direction to the glacier at its head. From the western side West Arm extends westward about 6½ miles. The port is not surveyed; the depths in the middle are over 100 fathoms until well toward the head of West Arm.

Sunday Harbor, on the east side, opposite the entrance of West Arm, is a small, double-headed bay, with anchorage for vessels of any size in its southeastern cove. The southern point at the entrance has a few rocks close-to, and a reef marked by kelp extends westward from it. The western end of the reef is a very dangerous sunken rock, barely covered at low water, lying about ⅜ mile 295° true (W mag.) from the point.

To enter Sunday Harbor, stand up the middle of the port on a 357° true (NNW ½ W mag.) course, heading for the glacier at the head until off the entrance of the harbor. Enter the harbor on a 90° true (NE by E ¾ E mag.) course, with the head of the harbor ahead and a high wooded islet on the southern side of West Arm astern. Anchor with the southwest point at the entrance to Port Dick open from the southeast point of the harbor, in 12 to 15 fathoms. There are a number of high-water islets at the head of the harbor.

The arm of Sunday Harbor northwest of the anchorage has a large grass-covered rock in its entrance.

West Arm of Port Dick is about 1 mile wide at the entrance, and extends 295° true (W mag.) for 2½ miles to the narrowest part of the arm, and then 291° true (W ⅜ S mag.) about 3¾ miles, where there is anchorage in 13 to 15 fathoms below the rocky islet, with a few trees on top, which lies near the southern shore. The flat at the head extends below the houses on the north side, and vessels can not go above the islet. There is a cascade inside the islet.

There is a bare reef close to the south point at the entrance to West Arm, and a high wooded islet lies on the south side, about ¾ mile inside the entrance of the arm.

On the north side of West Arm is a bay with an island in it. Anchorage is reported in the bay eastward of the island.

Taylor Bay, the north arm of Port Dick, is reported to be foul.

In the southwest approach to Port Dick there is a dangerous sunken rock, locally called **Gore Rock**, having 8 feet at mean lower low water, lying 7½ miles 244° true (SW ½ S mag.) from Point Gore and 8½ miles 74° true (NE ⅜ E mag.) from the southeast point of East Chugach Island. It lies about ¾ mile outside the line between these points and approximately 3½ miles from shore.

CHUGACH ISLANDS

are three large, mountainous islands, named in order from eastward—East Chugach, Pearl, and Elizabeth Islands, near the coast of Kenai Peninsula at the entrance of Cook Inlet.

East Chugach Island is about 3¾ miles long and mountainous, and has a low valley through the middle in a northeasterly and southwesterly direction. The south peak has an elevation of 1,451 feet, and the peak near the west end is higher. The southeast point of the

island is a cliff with a peak at its crest and slightly lower land back of it before rising to the mountains. There is a light on this point. The northwest point of the island is a low wooded point or spit. There is considerable foul ground between the island and the coast. The passage between East Chugach and Pearl Islands is clear and is used by vessels passing inside of Pearl and Elizabeth Islands.

Pearl Island is about 2½ miles long and 1¾ miles wide. It is mountainous, with elevations up to 1,742 feet, but its northwest part is much lower. Its northwest point is a sand spit on the west side and a high cliff on the north side. High bare rocks extend ½ to ¾ mile off the middle of the south side of the island.

Nagahut Rocks are three large, prominent, bare rocks, close together and connected at low water, lying 1½ miles southwestward from the southwest end of Pearl Island, with foul ground and no safe passage between.

Dora Reef is a small patch of sunken rocks, on which the sea breaks at low water with a moderate sea, lying 1¼ miles 238° true (SW by S mag.) from Nagahut Rocks. It is steep-to.

There is deep water in the passage between Nagahut Rocks and Dora Reef on the southeast and Elizabeth Island on the northwest, but a depth of 6 fathoms was found ½ mile eastward from the rock or islet close to the southeast end of Elizabeth Island, and 4 fathoms 1 mile westward of the west end of Pearl Island.

A reef, bare at low water, makes out about ⅝ mile from the eastern side of the prominent point on the north shore between Pearl and Elizabeth Islands. On the northeast part of the reef, about one-third the distance from the shore to its end, is a bare ledge that always shows above water. The outer rock that shows at low water lies about ⅞ mile 130° true (ESE ⅝ E mag.) from the point and about 1⅛ miles 333° true (NW ⅝ W mag.) from the northwest end of Pearl Island. This is the worst danger in the passage inside of Pearl and Elizabeth Islands.

Elizabeth Island is about 3 miles in diameter and is two mountain masses, with elevations up to 1,656 feet, and a low valley between them extending through in a northwesterly direction. The northeast point of the island is a sand spit, awash at high water. There is a prominent, large, bare rock close to the north shore of Elizabeth Island about⅜ mile westward of the sand spit. Southward of the rock, kelp makes out about 350 yards from Elizabeth Island. **Cape Elizabeth** is the western end of the island.

The passage inside Pearl and Elizabeth Islands is commonly used by vessels entering Cook Inlet from eastward. It is about 1 mile wide, and depths of 9 to 10 fathoms were found in the shoalest part of the channel between the southeast end of Elizabeth Island and the dangerous reef extending from the north shore.

There are strong **tidal currents** in the passage on either side of Elizabeth Island, and heavy tide rips occur from the northwest end of Pearl Island to the western end of the passage. The heaviest rips are in the vicinity of Pearl Island, with an ebb current and easterly wind. Heavy rips also occur off the southeast point of East Chugach Island. The turn of the current occurs later, possibly as much as one hour, in the passage than in the main entrance south of Elizabeth Island.

DIRECTIONS, INSIDE PEARL AND ELIZABETH ISLANDS.

From a position 1 mile south-southeastward from the southeast point of East Chugach Island, steer 293° true (W ⅛ S mag.) for 8 miles to a position ½ mile off the high north point of Pearl Island. Then steer 275° true (WSW ¼ W mag.), heading for the high south peak of Elizabeth Island. When Nagahut Rocks bear 180° true (SSE ¼ E mag.), steer 347° true (NW ⅝ N mag.), heading for the prominent white scar in the cliffs on the north shore of the approach to Port Chatham, and pass about mid-channel between the shores of Elizabeth Island and the mainland.

When the large bare rock close to the north shore of Elizabeth Island is abeam, and is closed with the north shore of Elizabeth Island west of it, steer 284° true (W by S mag.) for about 4½ miles, with the middle one of the three highest peaks on the eastern shore astern, and pass ⅜ mile northward of the rock and over 1 mile southward of the yellow bluff at the east entrance point of Koyuktolik Bay.

Then steer 307° true (WNW ⅞ W mag.) with the sharp southwest peak of Pearl Island showing over the middle of the low valley in Elizabeth Island astern, and pass 1½ miles southwestward of Point Adam.

DIRECTIONS, POINT GORE INSIDE EAST CHUGACH ISLAND.

This area was partly surveyed in 1915. The results of this survey indicate the existence of a good channel inside East Chugach Island, with least depths of about 12 fathoms off the north spit, and depths of 20 to 80 fathoms eastward of the island.

On the other hand, the depths found were very irregular, and a more detailed examination might reveal shoaler areas than those already found. The region is one which should not be considered free from danger until it has been dragged.

A kite, set to depths of 12 fathoms from Elizabeth Island to the spit of East Chugach Island, and 15 to 20 fathoms in the deeper water eastward, was towed over the track here recommended. In using the passage, therefore, vessels are advised to follow this track closely, as elsewhere there is not, as yet, adequate assurance that the passage is free from dangers.

From a position 1⅝ miles off Point Gore, steer 265° true (SW by W ⅜ W mag.) with the end of the sand spit on the northwest end of East Chugach Island right ahead, and in range with the south shore of Elizabeth Island. This course passes midway between Gore Rock and another rock, bare at low water, which lies 2⅜ miles 352° true (NNW ⅞ W mag.) from Gore Rock. Hold this course for 12 miles, until the southeast end of East Chugach Island bears 220° true (S by W ⅜ W mag.), then steer 283° true (W by S mag.) for 4½ miles for the head of Chugach Bay, passing 1¾ miles off the northeast point of East Chugach Island.

When the end of the spit on the northwest end of the island bears 211° true (S ½ W mag.) haul sharply to a 236° true (SSW ¾ W mag.) course, heading midway between the two peaks of Pearl Island, and pass in mid-channel between the end of the spit and the bare reef off the south point of Chugach Bay. At the above change in course the reef on the north shore of East Chugach Island just eastward of the

end of the spit should be abeam and in range with the high western peak of the island. Hold this course for 2.9 miles, until the rock off the south point of Chugach Bay bears 9° true (N by W ⅜ W mag.), and then steer 264° true (SW by W ¼ W mag.) for 3¼ miles, heading for the rocks off the south shore of Elizabeth Island, to a point ½ mile off the high north point of Pearl Island. Then proceed as directed for the passage inside Pearl and Elizabeth Islands.

In following the above courses, care should be taken to make proper allowance for the currents which set in and out of Port Dick, and diagonally across the course in approaching East Chugach Island. Because of these currents, the passage should not be attempted unless the weather is clear enough to permit the leading marks to be seen.

BARREN ISLANDS

are six, mountainous, grass-covered islands nearly in the middle of the entrance to Cook Inlet between Chugach Islands and Shuyak Island, and are about 13 miles long and 5 miles wide. The best anchorages are Amatuli Cove and the northern bight in the western end of Ushagat Island. Some sounding has been done, and the dangers so far as known are mentioned.

The **tidal currents** have great velocity among and outside the islands, the flood current setting northwestward and being apparently stronger than the ebb. Heavy tide rips occur with strong winds in the vicinity of the islands, and during spring tides are frequently dangerous for small vessels.

East Amatuli Island, at the eastern end of the group, is about 2 miles long and has a high peak at either end joined by a sharp ridge, which at the head of Amatuli Cove is about 300 feet high. A rocky islet about 100 feet high lies 250 yards off its eastern end.

Amatuli Cove, on the northwest side of East Amatuli Island, is about ½ mile in diameter and a good anchorage for small vessels. With heavy northeast winds, considerable sea makes in to the anchorage unless well in the bight, but the wind is little felt. The anchorage is in the middle, abreast or inside the north point of the cove, in 6 to 11 fathoms, mud and rock bottom. Scattered kelp grows in places in the cove, and along the shores there is thick kelp, which makes out farthest on the southeast side. There are no known dangers outside the thick kelp. There is a stream at the head of the cove.

Approaching from southward pass about ½ mile westward of Sugarloaf Island and in mid-channel between East and West Amatuli Islands, course about 38° true (N by E ¼ E mag.). The least depth found was 7 fathoms when the southwest peak of East Amatuli bore about 103° true (E by N mag.).

Approaching Amatuli Cove from northward pass in mid-channel between East Amatuli Island and the bare rocks (about 20 feet high) lying ⅝ mile eastward from the northeast end of West Amatuli Island. The least depth found in this entrance was about 12 fathoms.

West Amatuli Island is about 3 miles long and mountainous. A cluster of rocks about 20 feet high lies about ⅝ mile eastward from the northeast end of the island, with a reef between. A bare rock lies close to the northwest point of West Amatuli, and a dangerous rock, awash at low water and on which the sea generally breaks, lies about

1¼ miles 348° true (NW ¾ N mag.) from the same point and 3¼ miles 88° true (NE by E ⅝ E mag.) from the summit of Nord Island.

Sugarloaf Island, 1⅛ miles southward of East Amatuli Island, is about ¾ mile in diameter and about 1,200 feet high. A large bare rock lies ⅜ mile southeastward of it, with foul ground and breakers between. There is also a rocky islet close to its eastern end, and breakers extend nearly ¼ mile off its western end.

Nord Island, 1¼ miles northward from the eastern end of Ushagat, with deep water between, is about ½ mile in diameter. Its southern half is a dome 570 feet high, while its northern half is lower and irregular.

Sud Island, 1⅛ miles off the southeast end of Ushagat, is 1⅛ miles long and about 1,200 feet high near its southwestern end. Near its northeastern end is a knob over 300 feet high.

A small rocky island over 200 feet high lies 1½ miles southeastward from the south end of Ushagat. A low rock and breakers lie 600 yards, and two large bare rocks lie ¾ mile southward from it.

Ushagat Island, the westernmost and largest of the Barren Islands, is 6¾ miles long and 3½ miles wide near its western end. It is practically inaccessible except at the low neck near the northeast end and at several beaches fronting the valley in its northwest part. The southern part of the island is high, rocky peaks, with elevations up to 1,985 feet. Table Mountain, at the northeast end, is 1,356 feet high, and is separated from the other high land of the island by a low, narrow neck. There are several fresh-water lakes.

Two rocks, nearly awash at high water, lie ⅜ mile northward from the northwest end of Ushagat.

A bare rock about 5 feet high lies ⅞ mile southwestward from the northwest end of Ushagat. A reef awash at half tide lies 250 yards northwestward from the bare rock. A bare reef, nearly awash at high water, lies ½ mile eastward from the bare rock and ⅜ mile 260° true (SW by W mag.) from the high bare rocks close to a point of Ushagat ⅜ mile southeastward of its northwest end.

The west side of Ushagat Island is indented about 1 mile by an open bay, about 2½ miles long, and having two bights. A good anchorage for all easterly winds may be had in the bight at the north end of the bay. **To enter from westward**, give the northwest end of the island a berth of 1 mile and pass about ½ mile westward and southward of the bare rock lying ⅞ mile southwestward from the northwest end. Then steer 92° true (ENE mag.) for Table Mountain and anchor about ⅜ mile from shore in 6 to 8 fathoms, hard bottom. Kelp extends some distance off the point dividing the bights on the east side of the bay.

Bare rocks extend ⅜ mile southwestward from the southwest end of Ushagat Island.

COOK INLET.

Surveys are available of all parts of Cook Inlet northward of Port Graham and Augustine Island, with the exception of the head of Kachemak Bay above Coal Bay, and parts of Turnagain Arm. The inlet is shown on charts 8502, 8553, and 8554, Knik Arm on chart 8557, Iliamna Bay on chart 8665, Port Chatham on chart 8588, and Port Graham and Seldovia Bay on chart 8589.

Prominent features.—The shore on both sides of the inlet can be seen in clear weather, but it is sometimes difficult to locate the position on account of the lack of marked features on the eastern shore and the currents are so strong that logged distances are deceptive. Augustine, Iliamna, and Redoubt volcanoes are conspicuous and useful marks in the lower inlet, and Mounts Susitna and Spurr in the upper inlet. The numerous peaks of the high land southward of Kachemak Bay and northward from Kamishak Bay, Anchor Point, the 1,900-foot hill lying 10 miles from the east shore between Capes Starichkof and Ninilchik, Chisik Island, Kalgin Island, East, West, and North Forelands, Point Possession, and Fire Island are prominent in their respective localities.

Dangers.—The shoals in Cook Inlet are generally strewn with bowlders, which lie on the otherwise flat bottom, give no indication to the lead unless it strikes them, and are not marked by kelp. Most of those located by the survey were found by sighting them at low water. Many of the bowlders are of sufficient size to show above low water in depths of 30 feet. As a measure of caution, therefore, it is considered advisable for vessels to avoid areas having depths not more than 30 feet greater than the draft. At low water deep-draft vessels should avoid areas with a charted depth less than 10 fathoms.

In general the shoal banks fronting the marshy parts of the shores in the upper inlet are free from bowlders, the deposit having been sufficient, apparently, to cover them; but there are indications that bowlders do occur in the deeper water outside these banks.

With an average tidal current there are swirls throughout the inlet, but they do not necessarily indicate dangers as they show in depths of 15 fathoms if the bottom is uneven. Heavy swirls with slight overfalls should be avoided, and any disturbance which has a recognized wake in the water should be considered as indicating a dangerous rock or shoal.

The waters of the inlet are much discolored by glacial silt. At low water the discoloration may extend to the mouth of the inlet, and at high tide the water may be comparatively clear to East and West Forelands or even above. Frequently with either a flood or ebb current the water above the Forelands appears as a liquid mud.

Harbors and anchorages.—Port Graham, Seldovia Bay, Kahsitsnah Bay, and Coal Bay in Kachemak Bay, Iniskin Bay, Tuxedni Harbor, and Knik Arm are the secure harbors in the inlet, and the anchorage at East Foreland (Nikishka) is sheltered from all easterly winds. Temporary anchorage in thick weather can be selected at most places in the inlet with the aid of the chart. On account of the great range of the tides, the stage of the tide must always be kept in mind when anchoring to insure a depth sufficient to lie afloat and have swinging room at low water.

Settlements and supplies.—There are stores and settlements at Port Graham, Seldovia, Kenai, Susitna, Anchorage, Knik, Hope, and Sunrise, and at the canneries operating during the summer at Kenai and Kasilof. Woodrow Creek, in Knik Arm, is the headquarters from which the railroad is being constructed into the interior. From this point the mail goes to Hope and Sunrise during the summer.

Water is piped to the wharf at Port Graham and Seldovia. It can also be readily obtained from numerous streams along all of the high shores. In the upper inlet water is difficult to obtain and is accessible only at high water. The streams at East Foreland (Nikishka), the north side of Point Possession, and in Knik Arm are the only ones known where a vessel can approach the shore closely enough to permit boating water in any quantity.

Weather.—The prevailing winds during the summer are easterly with rain, the gales during that time being from the same direction. In the late summer and early fall, fresh southwesterly winds with clear but hazy weather are of frequent occurrence in the lower inlet, but they seldom blow with much force above the Forelands. Fresh northwesterly winds may occur during the early summer; they are generally accompanied by rain and last from one to two days. At such times navigation in the inlet, except southward with an ebb tide, is uncomfortable and even dangerous for small vessels.

Easterly gales become more frequent in the fall, and southeast gales may also be expected in and following September. Snowstorms may be expected from the 1st of October to the last of April. Cloud caps forming about the high peaks are generally followed by easterly weather and rain.

Fog may be expected occasionally during the summer. Its duration without partially clearing is generally short, although spells of generally foggy weather may last several days.

Ice.—The winter of 1915–16 was the first in which there had been any attempt at navigating the upper inlet after the ice had begun to form. The data as yet available is very meager, but the following statement will furnish a close approximation of prevailing conditions:

The upper part of the inlet is more or less obstructed by floating ice, which forms on the flats and in the shallower waters from December to April. The determining factor is the severity of the winter, which varies greatly from year to year.

During a mild winter or after a period of several days of mild weather, vessels will probably have no difficulty in reaching the head of the inlet and lying at anchor long enough to discharge their cargoes to lighters alongside.

During a severe winter or after a considerable period of severe cold such a course is not feasible; full-powered vessels could probably reach the head of the inlet even at such times but, because of the heavy masses of ice floating in the strong currents, would find it impracticable to discharge to lighters, either when lying at anchor or drifting with the current.

Ice does not generally interfere with navigation southward of Anchor Point except on the western side of the inlet, where large fields of it are sometimes carried by wind and tide as far as Augustine Island, closing Iliamna Bay for brief periods.

The tides fall below the plane of mean lower low water when minus tides occur in the tide-table predictions for Kodiak, the amount being greater in Cook Inlet. A safe rule for Cook Inlet is to multiply by 3 the minus heights taken from the Kodiak predictions, the maximum fall of the water below mean lower low water in Cook Inlet being about 6 feet.

CURRENTS. COOK INLET.

The tidal currents have great velocity in Cook Inlet and must be considered at all times. The small local steamers plan their trips so as to have a favorable current and prefer to anchor rather than steam against the current of a large tide. A vessel with a speed of 8 knots, picking up the flood current of a large tide a little northward of Anchor Point, can carry it to Fire Island.

At the entrance of Cook Inlet the tidal currents have an estimated average velocity of 2 to 3 knots at strength, and in general the velocities increase up the inlet, with maximum velocities in the vicinity of Harriet Point, East and West Forelands, and the entrances to Knik and Turnagain Arms. The maximum current velocity measured by the *McArthur* was 5 knots at anchorages near East and West Forelands, Tyonek, and Point Mackenzie. These anchorages were out of the full strength of the current, and there is little doubt that the maximum velocity of the current at the strength of a large tide is as much as 8 knots between East and West Forelands and probably more between Harriet Point and the south end of Kalgin Island.

The following statements are made from observations taken near the shores, and it is probable that the velocities in the main channel exceed these somewhat; also, since the current runs in the channel somewhat longer than it does near the shore, the times in the channel may be a little later than these given.

In general, the direction of the current is approximately parallel to the trend of the nearest shore, and when flats are uncovered, parallel to their edges. Off the various bays a set may be expected, toward the bay on a flood current and from the bay on an ebb current.

At Dangerous Cape.—A current of nearly 3 knots sets at times across the broken ground around the cape, causing heavy rips and overfalls.

Kachemak Bay.—From Dangerous Cape, a flood current sets up Kachemak Bay with a velocity of 1 to 2 knots in a northeasterly direction, and the ebb flows in a southwesterly to westerly direction. The currents at the mouth of the bay are uncertain, and may vary from place to place, making it difficult to make correct allowance for set in crossing from Anchor Point to Seldovia.

At Seldovia.—The tidal currents have an estimated velocity of 1 to 2 knots at strength.

At Anchor Point.—The strength of flood and ebb occur, respectively, 1 hour and 10 minutes before the times of high and low waters at Kodiak. Slack water before flood and ebb occur, respectively, 2 hours after the times of low water and high water at Kodiak. The mean velocities of the current at the strength of flood and ebb are 2.4 and 1.9 knots, respectively, the greatest currents observed being 2.8 knots on the flood and 2.2 on the ebb.

Off Cape Kasilof.—The strength of flood and ebb occur, respectively, at the times of high water and low water at Kodiak. Slack water before flood and ebb occur, respectively, 2 hours and 40 minutes before the times of high and low waters at Kodiak. The mean velocities of the current at strength of flood and ebb are 2.4 and 2.6 knots, respectively, the greatest currents observed being 2.8 knots on the flood and 2.9 on the ebb. In the middle of the channel east of Kalgin Island, the currents at times may exceed 5 knots.

Off East and West Forelands.—The strength of flood and ebb occur, respectively, 30 minutes after the times of high water and low water at Kodiak. Slack water before the flood and ebb occur, respectively, 2 hours and 15 minutes before the times of high water and low water at Kodiak. The mean velocity of the current at strength of flood and ebb is 3.3 knots, the greatest current observed being 5 knots, and is probably greatly exceeded at times in the middle of the channel.

Off Moose Point.—The strength of flood and ebb occur, respectively, 1 hour and 15 minutes after the times of high water and low water at Kodiak. Slack water before the flood and ebb occur, respectively, 1 hour and 40 minutes before the times of high and low waters at Kodiak. The mean velocities of the current at strength of flood and ebb are 2.8 and 2.5 knots, respectively, the greatest current observed being 2.9 knots on the flood and 2.6 knots on the ebb.

Off the west side of Fire Island.—The strength of the flood and ebb occur, respectively, 1 hour and 45 minutes after the times of high and low waters at Kodiak. Slack water before flood and ebb occur, respectively, 1 hour and 10 minutes before the times of high and low waters at Kodiak. The mean velocities of the current at strength of flood and ebb are 2.8 and 1.5 knots, respectively, the greatest current observed being 3 knots on the flood and 1.6 knots on the ebb.

Off Point Woronzof.—The strength of the flood and ebb occur, respectively, 2 hours and 15 minutes after the times of high and low waters at Kodiak. Slack water before the flood and ebb occur, respectively, 50 minutes before the times of high and low waters at Kodiak. The mean velocity of the current at strength of flood and ebb is 4.5 knots, the greatest currents observed being 5 knots on the flood and 4.6 knots on the ebb.

In Knik Arm, South of Goose Creek.—The strength of the flood occurs 2 hours and 30 minutes after the time of high water at Kodiak, and the strength of the ebb 3 hours and 40 minutes after the time of low water at Kodiak. Slack water before flood and ebb occur, respectively, 20 minutes after the times of high and low waters at Kodiak. The mean velocities of the current at strength of flood and ebb are 3.4 and 3.7 knots, respectively, the greatest currents observed being 5.7 knots on the flood and 5.4 knots on the ebb.

At Knik Harbor.—The tidal currents have moderate velocity at the anchorage near the shore, and are strong in mid-channel.

Turnagain Arm.—The currents are very strong, and the flood frequently comes in as a bore, with spring tides, under certain weather conditions. This bore is said at times to be 4 to 6 feet high, and is very dangerous for small craft. Boats should be beached well above the level of the flats, and thus avoid the bore when it comes in. The bore can be heard about ½ hour before it reaches one, sounding like breakers on the beach; it travels slowly.

Harriet Point.—The currents are very swift at Harriet Point, exceeding 5 knots on spring tides, and with southerly breezes bad tide rips occur between Harriet Point and Kalgin Island, and extend some distance southward.

Tuxedni Harbor.—Slack water before the ebb occurs 45 minutes after the time of high water at Kodiak, and slack water before the flood 1 hour and 45 minutes after the time of low water at Kodiak. The greatest observed currents are 2.2 knots on the ebb and 1.7 knots on the flood. The currents set fair with the channel.

Iniskin Bay.—The currents set fair with the channel. At the entrance, the strength of the flood and ebb occur, respectively, 1 hour and 40 minutes before the times of high and low waters at Kodiak. Slack water before the flood and ebb occur, respectively, 1 hour and 30 minutes after the times of low and high waters at Kodiak. The mean velocities of the current at the strength of the flood and ebb are 1 and 1.2 knots, respectively, the greatest currents observed being 1.3 knots on the flood and 1.6 knots on the ebb.

Kamishak Bay.—In the northern part of the bay, the currents follow the coast, flooding northeastward and ebbing southwestward at a rate of 1 knot at strength. The current seemed to flood inside of Augustine Island and then flow toward Chinitna Point. A slight set northward was observed on the flood, and westward on the ebb. The current was more noticeable near the shore. With a strong westerly wind, tide rips occur about 2 to 4 miles north of Chinitna Point. A very slight current was observed off Rocky Bay, and at time of low water a small rip was seen near the reefs off Rocky Bay.

DIRECTIONS, COOK INLET.

The tidal currents have great velocity in Cook Inlet and must be considered at all times. The small local steam vessels plan their trips so as to have a favorable current, and prefer to anchor rather than steam against a current of a large tide.

A vessel with a speed of 8 knots, picking up a flood current of a large tide a little northward of Anchor Point, can carry it to Fire Island.

The shoals fringing the shores of Cook Inlet are generally strewn with bowlders, and the lead is not a sufficient guide to avoid them. As a measure of safety deep-draft vessels should avoid areas with depths less than 10 fathoms southward of the Forelands. The following courses are suggested:

From a position with Cape Elizabeth bearing 359° true (NNW ¼ W mag.) distant 5½ miles, make good a 335° true (NW ⅜ W mag.) course for 13½ miles, passing 2 miles off the outer rocks near Cape Elizabeth and Point Adam; Flat Island light should then bear 28° true (N ¼ E mag.) distant 4½ miles.

Then make good a 0° true (NNW ¼ W mag.) course for 31 miles to a position with Anchor Point light abeam, distant 6 miles.

Then make good a 16° true (N ⅞ W mag.) course for 43 miles to a position with the northeast point of Kalgin Island abeam, distant 5 miles.

Then make good a 12° true (N by W ¼ W mag.) course passing midway between East and West Forelands, and continue the course for a total distance made good of 19 miles.

Then bring the southeast end of West Foreland astern on a 57° true (NNE ⅝ E mag.) course, and make good this course for 45 miles to a position ¾ to 1 mile northwestward of Race Point, Fire Island. To make good this course, it is imperative to make proper allowance for the currents setting to or from Turnagain Arm. An allowance of as much as two points is sometimes necessary.

Passing ¾ to 1 mile off Race Point, a 65° true (NE ⅝ N mag.) course for Point Mackenzie leads in about the best water across the bar at the entrance to Knik Arm. Having in mind, however, the

difficulties of navigation due to strong currents and swirls, vessels should not depend on finding a greater depth than 17 feet at mean lower low waters. Vessels of less than 15 feet draft going at moderate speed should experience no difficulty at mean lower low water; those of greater draft should wait for sufficient tide to insure a safe passage. When Point Woronzof bears southward of 95° true (ENE mag.) the bar will have been passed and a mid-channel course should then be followed until up with Cairn Point, above which the channel favors the western shore as shown on the chart.

It is important to have in mind the minus tides on the bar at the entrance of Knik Arm. See tides preceding.

PORT CHATHAM

lies northward of Elizabeth Island, and has a 25° true (N mag.) direction for 2 miles, narrowing from about 2 miles to ½ mile. It then turns to about 115° true (E mag.) for 1½ miles with a width of ⅜ to ½ mile. It is a secure harbor for vessels of any size and easily entered in the daytime with clear weather. During heavy gales some williwaws are felt at the anchorage, but they are not dangerous. Southward of Chatham Island the shores are foul, but northward of it the main part of the harbor is clear. The dangers are marked by kelp with the water below half tide. The mountains on either side of the harbor and approach rise abruptly from the water and are wooded about halfway to the summits.

Claim Point, on the west side at the entrance, is a wooded hill 220 feet high, with a low wooded neck back of it. Bare rocks and kelp extend about 400 yards off the southeast side of the point. The bay between Claim Point and Kelp Point has considerable foul ground, and there are depths of 4 to 6 fathoms in the entrance.

Kelp Point is on the west side ½ mile northeastward from Claim Point. A bare rock lies 250 yards southeastward from Kelp Point, and kelp extends ¼ mile eastward from the rock toward Chatham Island. Care should be taken to avoid it at high water when the kelp does not show.

Chatham Island, small, low, rocky, and partly wooded, lies in the middle of the port about 1¼ miles inside the entrance. The channel is west of the island, and the only known danger is a rock with 7 feet over it, marked by kelp except near high water, nearly in the middle 354° true (NNW ¾ W mag.) from the island. There is deep water on either side of the rock. A depth of 5 fathoms, with a possibility of less, was found 250 yards 230° true (SSW ¼ W mag.) from the western end of Chatham Island.

The passage east of Chatham Island is foul and should not be attempted by strangers. A rock, with 13 feet over it and marked by kelp, lies ⅜ mile from the eastern shore and over ⅝ mile 165° true (SE ½ S mag.) from the western end of Chatham Island.

On the east side, ⅝ mile north-northeastward from Chatham Island, is a projecting, rocky, wooded point, where the port changes direction. The opposite side, northeastward from this point, is a low, grassy spit, wooded near its eastern end. The best anchorage is in the broad part of the harbor ¼ to ½ mile eastward of this spit, in 10 to 13 fathoms, soft bottom. At the eastern end of the harbor are some rocks showing but little above high water. On the south shore, 188° true (S by E

½ E mag.) from these rocks, fresh water can be conveniently obtained by boats, which can be placed under a waterfall at the higher stages of the tide.

Tides.—High and low water occur about the same time as at Kodiak, and the mean rise and fall of the tides is 12.1 feet. To find the height of the tide at Port Chatham, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.75. The tidal currents have little velocity in the entrance and harbor, but in the approach on either side of Elizabeth Island there are strong tidal currents, and at times heavy tide rips.

DIRECTIONS, PORT CHATHAM.

The entrance and harbor of Port Chatham are very broken and not completely developed. As a measure of safety vessels should proceed with caution in the vicinity of broken areas where abrupt changes in depth are indicated by the chart to depths less than about 15 fathoms.

From eastward.—Follow the directions for passing inside Pearl and Elizabeth Islands preceding, until up with Elizabeth Island, and then steer 356° true (NNW ½ W mag.) with Nagahut Rocks astern and Chatham Island a little on the starboard bow. Pass 500 yards southwestward of Chatham Island and steer 47° true (NNE mag.), passing 150 to 200 yards westward of the island. When inside the prominent point ⅝ mile above it, steer about 109° true (E ½ N mag.) in midchannel for ¾ mile to the anchorage.

From westward.—Reverse the direction for passing inside Pearl and Elizabeth Islands, page 78, until approaching Elizabeth Island, or enter about midway between Elizabeth Island and the shore northwestward. Then steer about 47° true (NNE mag.) for the west end of Chatham Island with the hummock at the west end of Elizabeth Island astern. Pass 500 yards southwestward and 150 to 200 yards westward of Chatham Island and continue to anchorage as directed in the preceding paragraph.

COAST FROM PORT CHATHAM TO SELDOVIA.

Koyuktolik Bay, about 3 miles westward of Port Chatham, is 1½ miles long, with a uniform width of about 1 mile. Its north shore consists of bare rocky cliffs, while the south shores are lower, the south entrance point consisting of a low yellow bluff. The entrance is clear, with depths of 14 to 16 fathoms, except for a reef which makes off about 600 yards from the yellow bluff point. A sand and gravel shoal makes out about ⅜ mile from the stream in the southeast corner at the head of the bay.

Temporary anchorage in 8 to 10 fathoms, hard bottom, may be found ½ mile from the head of the bay. It is probable, however, that in any heavy weather a considerable swell reaches this anchorage.

Point Adam, 6½ miles 336° true (NW ⅜ W mag.) from Cape Elizabeth, is low at the end, and rises in a steep grassy slope to mountains.

Magnet Rock lies 3¼ miles 345° true (NW ⅜ N mag.) from Point Adam and about ⅜ mile from the coast in the vicinity of Point Bede. It is small, black, and prominent.

Flat Islet, 1⅛ miles 13° true (N by W mag.) from Magnet Rock, is small, flat, grass-covered, and about 50 feet high, and is two closely

connected islands joined by bare reefs. There is a light on the northwest part of the island.

Port Graham is described below.

There is a prominent, flat-topped, grassy point, with rocky sides and about 50 feet high, 6½ miles northward of Flat Islet and 1½ miles northward of Dangerous Cape. Its end is detached. At this point the coast changes direction northeastward for about 5 miles to Seldovia Bay.

Kelp extends ½ mile off the bight lying 2 miles southwestward of Point Naskowhak.

PORT GRAHAM,

on the east side of Cook Inlet, 4 miles northward of Flat Island, is a secure harbor inside Passage Island, and with care is easily entered in the daytime. Its entrance, between Russian Point and Dangerous Cape, is about 2 miles wide, and has extensive outlying reefs, covered at various stages of the tide. The dangers are generally steep-to and are marked by kelp in summer and fall.

Russian Point, on the south side of the entrance, lies about 2¾ miles northeastward of Flat Island. **Alexandrovsk,** a small Indian village with a Greek church, is on the northeast side of English Bay, 300 to 400 yards southeastward of the point.

English Bay, the open bight south of Russian Point, is not surveyed and should be avoided by strangers. English Bay Reef, bare at low water, lies about ¾ mile off the bay and 1 mile 268° true (SW by W ⅝ W mag.) from Russian Point. Foul ground also extends nearly ½ mile westward of Russian Point.

A reef bare at low water extends 600 yards northward from Russian Point. Between this reef and that extending ⅞ mile southwestward from Passage Island is a channel 250 yards wide, with depths of 6 to 8 fathoms on the rocky bar, leading into Port Graham southward of Passage Island. A small reef, with 7 feet over it, lies ⅝ mile inside Russian Point and 400 yards from the southern shore; the channel is northward of it.

Dangerous Cape, on the north side at the entrance, lies 5 miles northward of Flat Island. A reef extends ½ mile westward from the western side of the cape; there are two rocks bare at low water, and a rock with 7 feet over it lies nearly ½ mile from shore.

A reef, with bare rocks and some that cover, extends 650 yards southward from Dangerous Cape.

Bird Reef, 250 yards long, lies ½ to ⅝ mile southward from Dangerous Cape. The highest rock at the north end of the reef is covered at extreme high tide. A rock with 3 feet over it and marked by kelp lies nearly ¼ mile northeastward from the north end of Bird Reef.

Midway between this reef and Passage Island and ½ mile from the north shore is a small shoal with 2½ fathoms and kelp. Vessels should pass southward of it, as another shoal with kelp makes out 650 yards from the shore inside it, and there are probably bowlders on the shoals.

Passage Island, 1 mile inside the entrance, is 140 feet high and wooded. It is generally fringed with reefs to a distance of 150 yards, and a shelving spit, covered at high water, extends 350 yards eastward from its eastern end. A reef, with numerous rocks, bare and

covered at various stages of the tide, extends 7/8 mile southwestward from the western end of the island. The northern end of the island is marked by a light.

A rock, bare at low water, lies 250 yards west-southwestward from the point on the north shore northeastward of Passage Island. This is the worst danger in the entrance north of the island. The channel has a width of 300 yards between the rock and the reef fringing Passage Island.

Above Passage Island the port is 4½ miles long and ½ to ¾ mile wide, with depths of 10 to 17 fathoms. The shores are generally fringed with kelp to a distance of 200 yards. The only serious danger is a narrow, sunken reef with kelp which extends halfway across the port from the northern shore 5/8 mile above Passage Island, and is marked at its south end by a black buoy. There are small streams on the shores of the port and a large stream and valley at its head.

There are a cannery and **wharf** on the south side 1 7/8 miles above Passage Island. There is a depth of 18 feet at its end. Water can be obtained through pipe and hose, and small quantities of coal are generally kept on hand. There is a small store.

Anchorage.—Temporary anchorage for a small vessel can be selected in the middle of Coal Cove, inside Dangerous Cape, in 5 to 10 fathoms, rocky bottom; the shore of the cove is fringed with kelp to a distance of 350 yards, and the cove should be used with caution. A better anchorage with more room will be found in the bight on the north shore northward of Passage Island in 7 to 10 fathoms; a shoal extends 400 yards from the northeast end of the bight, and kelp extends 250 yards from its north shore. These anchorages are exposed to a heavy swell in southerly or westerly weather.

When inside Passage Island, anchorage can be had in any part of the port, the depths being 17 to 10 fathoms. One of the best is northward or northeastward of the wharf, in 10 to 13 fathoms, sticky bottom. The cove southeastward of the wharf is shoal. An equally good anchorage is in the middle 1 mile above the wharf, in 9 to 10 fathoms; above this anchorage the port narrows to 3/8 mile, and is then shoal to the head, a distance of 1¼ miles.

Tides.—High and low waters occur about 18 minutes later than at Kodiak, and the mean rise and fall of the tides is 14.4 feet. To find the height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 2.1.

Strong tidal currents, both ebb and flood, set across the mouth of the harbor, but there is little current at or inside of Passage Island. With opposing wind and current, heavy tide rips occur off and well northward and southward of the entrance to Port Graham.

DIRECTIONS, PORT GRAHAM.

The safest time to enter the port is at low water, and the better entrance is north of Passage Island. The channel south of Passage Island should not be used by strangers.

From southward, pass 1 to 1½ miles westward of Flat Island and steer for the prominent coast point northward of Port Graham, course about 41° true (N by E ½ E mag.). When the village of Alexandrovsk is abeam, head in with Passage Island a little on the starboard bow, course about 92° true (ENE mag.), and pass about 300 yards northwestward of the light on the north end of the island.

Pass 200 to not over 300 yards northeastward of the light on the north end of Passage Island and steer 129° true (ESE ¾ E mag.), passing midway between the east end of the island and the point on the north shore. Continue the course 300 yards past the island, and then steer 157° true (SE ¼ E mag.), with the point on the north shore astern, and pass westward and southward of black can buoy No. 1. Then keep in mid-channel. A flat extends 1¼ miles from the head of the port, and the cove in the south shore southeastward of the wharf is shoal.

From northward.—Follow the shore northward of the port on a 210° true (S ½ W mag.) course, and pass over 1 mile westward of Dangerous Cape. Then steer for the village of Alexandrovsk, course about 168° true (SE ¾ S mag.), and when Bird Reef is about ½ mile on the port beam steer for the summit of Passage Island, course about 120° true (E ½ S mag.). When the point on the north shore northeastward of Passage Island bears 103° true (E by N mag.), steer for it and pass about 300 yards northwestward of the light on the north end of Passage Island. Then follow the directions in the preceding paragraph.

SELDOVIA BAY,

on the southeast side of Kachemak Bay, eastern shore of Cook Inlet, is a secure harbor in any weather. It extends 2 miles in a 176° true (SSE ½ E mag.) direction to Powder Island, with a width of ½ to ¾ mile, and then turns to 147° true (SE by E mag.) for 2 miles. The head of the bay is shoal down to ½ mile southeastward of Powder Island.

From the entrance until nearly up with the wharf, shoals with 10 to 12 feet in places on their eastern part extend halfway across the harbor from the western shore. The channel is between the shoals and several rocks and kelp patches near the eastern shore, and varies in width from 150 to 400 yards. The channel has a depth of 18 feet or more at low water, with a rise and fall of tides of 16 to 24 feet. The shoals and rocks are marked by kelp at slack water in summer and fall, but it is run under during the strength of the tidal currents.

Point Naskowhak, the western point at the entrance, is the northwest one of two small, high, rocky, wooded knobs which stand on a low, grassy spit surrounding a lagoon. A reef extends nearly ¼ mile northward from the point, and broken ground, marked by kelp, with 26 feet at its end, extends nearly ½ mile 41° true (N by E ½ E mag.) from it. Two kelp patches, in which the least depth found is 18 feet, lie 600 to 700 yards northeastward from the point.

Gray Cliff, the eastern point at the entrance, is a bare rock cliff 60 to 70 feet high, and is marked at the south end by a light.

Seldovia Point, lying 1 mile northward of Gray Cliff, is a cliff 200 feet high, wooded on top. Kelp extends ⅝ mile from the shore in the bight northeastward of Seldovia Point.

On the eastern side of the harbor, nearly ¼ mile southward of Gray Cliff, is a prominent high, reddish bluff, which is a good mark.

A rock, bare 4 feet at low water, lies 300 yards southwestward from the red bluff, with foul ground between. This rock is steep-to on its western side, and is the principal danger in the harbor. It is marked by a buoy.

A high, pointed rock with some dead brush on top lies near the eastern shore about midway between the rock and Watch Point.

Watch Point, on the eastern shore, ⅜ mile southward of the red bluff, is a small, grassy head, about 30 feet high, with a few trees, and a short, low, grassy neck behind it.

A rock, with 15 feet over it and marked by kelp, lies 150 yards 210° true (S ½ W mag.) from Watch Point. The channel is westward of the rock.

Seldovia is a village and post office, with several stores, a small hotel, and a Greek church, on the eastern side of the harbor, ¼ mile southeastward of Watch Point. The village has a few white men and about 100 Indians. A shoal, partly bare at low water, extends 200 yards southwestward from the point at the village, and the cove southeastward of it is nearly dry at a good low water. The southwest side of the cove is formed by a grassy head with a few trees about 75 feet high, which at its southeast end, at the inner end of the wharf, is joined to the shore by a low, narrow spit.

A cannery and wharf are on the eastern side of the harbor, ⅝ mile southward of Watch Point. The wharf has a depth of about 11 feet at its end. Water can be obtained through pipe and hose. The cannery shows, when approaching the harbor from southwestward, over the low spit westward of the entrance. When in the harbor the wharf is hidden until nearly up with it by the grassy head northwestward.

The best **anchorage** in the harbor is in the middle, about ⅜ mile 238° true (SW by S mag.) from the wharf, in 9 to 10 fathoms, sticky bottom. A small vessel can anchor in the channel off the village, with the high, red bluff open westward from Watch Point, and the Greek church bearing 86° true (NE by E ½ E. mag.), in 5 fathoms.

Tides.—High and low water occur 27 minutes later than at Kodiak. To find the height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 2.23. The tidal currents have an estimated velocity of 1 to 2 knots at strength.

DIRECTIONS, SELDOVIA BAY.

Steer for the north end of Gray Cliff on a 137° true (ESE mag.) course until Point Naskowhak is a little forward of the beam. Then steer for Watch Point in range with the pinnacle rock off the north side of the wooded head lying northwestward of the wharf, course 168° true (SE ¾ S mag.). A spot on Watch Point and the pinnacle rock are kept whitewashed; otherwise the pinnacle rock blends with the background. The course on the range should lead about 300 yards westward of Gray Cliff and about 50 yards westward of the rock, bare at low water.

When about 350 yards from Watch Point, and the high, pointed rock near the eastern shore is forward of the beam, steer 193° true (S by E mag.) and pass 125 to 150 yards westward of Watch Point. When about 200 yards past the point and the graveyard on the eastern shore is abaft the beam, steer 176° true (SSE ½ E mag.) and pass 200 yards off the point northwestward of the wharf. In going to the wharf, give the shore northwestward of it a berth of 100 yards.

EASTERN SHORE OF COOK INLET.

The eastern shore at the entrance of Cook Inlet is mountainous, with steep slopes from the water in the vicinity of Point Adam and Point Bede. The mountains trend northeastward between Kachemak Bay and the sea, and then extend across to the head of Turnagain Arm. The greatest elevations occur about halfway up Kenai Peninsula, where there are numerous glaciers. The coast and harbors from Port Chatham to Seldovia are included in the description preceding.

Kachemak Bay has secure anchorages at Kahsitsnah Bay and Coal Bay; above the latter the head of Kachemak Bay is not surveyed.

The point 2 miles northeastward of Seldovia Point is low, sandy, and prominent.

Nubble Point is a long sandspit terminating in a rocky knoll, which may be mistaken for Point Naskowhak if not sure of the position. The easterly part of the point is wooded.

Kahsitsnah Bay, between Nubble Point and Herring Islets, affords good anchorage in 12 to 15 fathoms, good holding ground. The water shoals abruptly to the shore, and to the flat which fills the cove formed by Nubble Point; but the flat in the cove will be avoided by keeping the easterly end of the point bearing westward of 14° true (N by W mag.).

A rock, bare at extreme low water and marked by heavy kelp, lies ½ mile 59° true (NE by N mag.) from the north end of Nubble Point. A least depth of 14 fathoms was found between the rock and Nubble Point, by giving the north end of the point a berth of over 200 yards.

Hesketh, Yukon, and Cohen Islands are high and wooded. There is an islet on the reef which extends ½ mile northwestward from Hesketh Island. A rock 60 feet high lies near the north end of a reef which extends ½ mile northward from Cohen Island. There is a prominent yellow cliff on the west end of Cohen Island. The passages between the islands should be avoided. **Eldred Passage**, eastward of the islands, is deep near the middle, except at the north end, where there is a bar on which the least depths found are 8 to 12 fathoms.

Tutka Bay has no desirable anchorage and is not completely surveyed. Broken ground, on which some pinnacle rocks have been found, extends across the entrance.

Sadie Cove, the inlet in the east side of Eldred Passage, is not completely surveyed, but is apparently clear near mid-channel.

A rock, bare at low water, lies ½ mile northward of the point lying 1½ miles northeastward of Cohen Island, and the bight eastward of the point is foul.

Gull Island is a prominent pile of bare rocks, visible about 10 miles; above the island Kachemak Bay is not surveyed.

Homer Spit is a low gravel and shingle spit, 3½ miles long, from 100 to 500 yards wide, and covered with grass and some trees. **Homer**, a village at the end of the spit, is practically abandoned. A wharf on the north side of the spit near its end is dry at lowest tides.

There is excellent anchorage at a distance of ¾ mile or more northwestward of the wharf, in 10 to 15 fathoms, soft bottom. Greater depths and abrupt shoaling are found near the wharf, and it is not

safe to anchor in less than 18 fathoms. **Coal Bay**, the bight northwest of Homer, is shoal, but there are no outlying dangers.

From Homer Spit to **Anchor Point** the coast is a line of bluffs, with a greatest height of 750 feet at Bluff Point. In front of the bluffs there is a narrow, rocky and shingle beach. The depths inside the 10-fathom curve are rocky and irregular, and there is a possibility of detached bowlders not found by the survey. There is a light on Anchor Point.

From northward of Anchor Point to **Cape Ninilchik** the coast is free from dangers so far as known, and anchorage can be selected, the bottom being sandy. The surveying vessel frequently used an anchorage close inshore just northward of Cape Starichkof, in 6 to 7 fathoms (low water). The holding ground is fair, and there is some shelter from southerly weather.

The hill, 1,900 feet high, lying 10 miles from the shore between Cape Starichkof and Cape Ninilchik, is a sharp peak with a high saddle between it and a slightly lower peak just southward, and is the only prominent feature between Anchor Point and the Forelands.

Ninilchik is a small native settlement with a Greek church at the mouth of a small stream. The church and a part of the village are prominent from well offshore.

North of Cape Ninilchik the coast is very foul, being characterized by immense bowlders not marked by kelp. The bowlders rest apparently on a comparatively flat bottom, so that soundings give no indication of them. From the appearance of those found and the soundings taken alongside, it is probable that there are many of the same character not found by the survey.

The Sisters are three prominent rocks, close together and the largest showing about 5 feet above high water. The foul ground inside the Sisters and extending about 10 miles southward from Cape Kasilof is strewn with bowlders from 15 to 50 feet high, of which the Sisters are the largest. There are many bowlders in this area not located by the survey.

There is a break in the high bluffs on the eastern shore between Cape Kasilof and Kenai.

Temporary anchorage can be had in 4 fathoms about ⅝ mile from shore a little southward of Cape Kasilof. This anchorage is exposed except in northeasterly weather.

Kasilof is a cannery on the northern bank at the mouth of **Kasilof River**. An extensive flat with bowlders in places fills the bight between Cape Kasilof and the mouth of the river, and extends offshore 2½ miles. A narrow winding channel, nearly dry in places at low water, leads through the inner shoals to the mouth of the river. This channel is marked for the cannery steamers and launches during the season. The river is narrow and has a strong current. Boats up to 6 feet draft can lie afloat in the river at low water.

To anchor off the cannery, stand for it on a 105° true (E by N mag.) course. Keep the lead going and anchor 3 to 4 miles from the cannery, in a depth not less than 5 fathoms at low water.

Karluk Reef, partly bare at low water, is 2½ miles long, its southern end lying 4 miles 298° true (W ¼ N mag.) from Kasilof cannery. There are shoals between it and the shore.

Kenai is a cannery and post office on the northern bank at the mouth of **Kenai River**. Extensive bowlder flats make off about 3

miles from the mouth of the river. **Salmo Rock**, which shows well at low water, is one of the outer ones of numerous scattered bowlders located by the survey, and lies 2¾ miles 232° true (SSW ⅜ W mag.) from Kenai Church. It is generally marked by a buoy, maintained by the cannery vessels. The bar at the entrance of the river is nearly dry at low water, and there are depths of 8 to 10 feet in places in the channel in the river. The tidal currents in Kenai River have a velocity of 3 to 6 knots. The currents turn about 1 hour after high water and about 2 hours after low water.

Salamato is an old village 4½ miles northward of Kenai and 6 miles southeastward of East Foreland.

East Foreland is a prominent, nearly level, wooded headland, with a bluff at the water 276 feet high. There is a light on the highest point of the bluff. A dangerous shoal with a least found depth of 17 feet (about 11 feet at lowest tides) lies 2 miles from the eastern shore for a distance of 3 miles southeastward from East Foreland. The area is not thoroughly developed.

Nikishka is a fish trap and house 2½ miles northeastward of East Foreland. There is good anchorage for a small vessel, sheltered from all easterly winds, ⅜ to ½ mile from shore abreast or a little below the fish house, bearing 151° true (SE by E mag.), in about 6 fathoms, good holding ground. An anchorage farther southwestward is not desirable, as the holding ground is not as good and the ebb current increases greatly in velocity on approaching East Foreland. Fresh water in small quantities may be had by boats at high water from a seepage just north of the fish house. Water in larger quantities may be had from a stream ¾ mile northeastward of the fish house, but the flow does not usually last through the summer.

From the fish house northward nearly to Boulder Point, a distance of 2½ miles, bowlder shoals, bare in places at low water, extend ¾ mile from shore.

Middle Ground Shoal, in the form of a long ridge of hard sand with rocky bottom in places, lies in the middle of the inlet 10 miles northward of East Foreland. It shows at low water for a distance of 3½ miles in a northeasterly and southwesterly (magnetic) direction, and its greatest height above low water is about 6 feet.

Beginning at **Boulder Point**, a prominent bowlder reef with but few breaks in it extends along shore to Moose Point, a distance of 20 miles. For the greater part of this distance the bowlders, some very large, show at low water to a distance of 2 miles from shore, and there are occasional ones which show above high water. A rock awash at low water lies 3½ miles from shore and 4 miles 346° true (NW ⅜ N mag.) from Gray Cliff; there is a depth of 10 fathoms close to the west side of the rock. Owing to the size of the bowlders along this shore, it is not safe to skirt it in a less depth than about 5 fathoms greater than the draft.

There is a prominent yellowish bluff 4 miles northeastward of Boulder Point. **Gray Cliff**, 164 feet high, lies 10 miles northeastward of Boulder Point, and is a good mark from the inlet. There is a break in the bowlder reef off Gray Cliff, and a small vessel may here approach the shore as close as ¾ mile, and find anchorage in about 5 fathoms, mud bottom, sheltered from easterly and southeasterly weather.

Moose Point is low and wooded, with a grassy flat at its end, and is not prominent. Between it and Point Possession, a distance of 10 miles, there are few bowlders so far as known, but the bottom is generally rocky and irregular. Moose Point Shoal, 5 miles long and partly bare at low water, begins just above Moose Point, and lies from 1¾ to 2¼ miles from shore.

About 6 miles northeastward of Moose Point there is a prominent reddish bluff, on the north side of which is a small stream in a deep canyon, the latter showing from southwestward.

Point Possession is a low, rounding, heavily wooded headland, with a bluff at the water. There is a small native village on the western side of the point, where the bluff is low and a valley leads inland. The bluff is 140 feet high ⅞ mile southward of the village, and from the village the bluff increases in height northeastward around into Turnagain Arm to a greatest elevation of 284 feet at Grand View.

A reef extends about 1 mile off the northwest side of Point Possession for a distance of about ¾ mile northward of the village. There are depths of 3 fathoms on its western edge; the northern edge drops off abruptly to depths of 12 to 20 fathoms. The range of the eastern side of Fire Island and Point Woronzof leads close to the western edge of the reef, and care should be taken when rounding the point at low water not to open this range until well clear of the reef. A current line generally indicates the edge of the reef when the tidal current is strong in either direction.

Temporary anchorage for a small vessel may be had ¾ mile from shore and 2 miles southward of the village in 4 fathoms, sandy bottom. It is sheltered from easterly and southeasterly winds, but considerable sea makes around Point Possession at times from the violent northeasterly winds that blow at intervals out of Turnagain Arm.

On the north side of Point Possession, temporary anchorage for a small vessel can be had in 4 fathoms, hard bottom, ¼ mile off a gulch at the western end of a high bluff 1¼ miles northeastward of the village. The anchorage is inside of the strong tidal currents that set in and out of Turnagain Arm. Water can be secured by boats at high water from the gulch, but in the late summer the flow is small and the water discolored by flowing over the clay bluff.

Turnagain Arm is partially surveyed, the shore line being correct. Most of the arm at low water is a large mud flat interspersed with winding sloughs, and navigation is safe only for small craft of 6 feet or less draft. Local knowledge is necessary since the channels wind from side to side and are subject to change, and strong currents and tide rips increase the difficulties of navigation. The flood tide comes in at spring tides as a bore, sometimes attaining a height of 6 feet. It travels about 6 knots, but the velocity of the current may exceed that in places.

Small craft generally use the anchorage on the west side of Fire Island until the conditions are favorable for proceeding up Turnagain Arm. The only anchorage in the arm is in the narrow channel close to the shore northward of Burnt Island; but it is exceedingly uncomfortable and even dangerous for launches when the strong easterly winds are blowing down the arm. For launches the best thing to do is to beach them on a gradually sloping, smooth sand beach in the

bight on the west side of Gull Rock or the bight on the west side of the small point 2 miles westward of Gull Rock.

Hope, Sunrise, and Girdwood have stores, and can be reached by small craft at high water. In 1914 mail and freight for these places came by launches from Knik Arm.

Turnagain Arm is noted for the violent winds which blow out of it whenever the wind is easterly, and is locally referred to as the "Cannon," which expresses the opinion held of it. With light to moderate easterly winds in other parts of the inlet, a moderate gale will frequently blow out of the arm and a heavy sea and tide rips will be raised from its mouth across to Ladd on the western shore.

Fire Island is wooded and has a greatest elevation of 350 feet near its middle. Its southern part is broken, there being some high sand hills with bare summits, between which is a lake. There is another lake near the north end of the island. The shore is high bluffs, except the northern and southern ends of the island, which are low. There are no streams on the island, and after the snow is melted the island is dry except for the lakes. Except in late summer some fresh water may be had at a depth of a few feet at the foot of the low bluff on the shore northwestward of the lake near the south end.

There is good anchorage for a small vessel in the northern part of the bight on the western side of Fire Island, in 4 to 5 fathoms, hard bottom. It is about ½ mile from shore and about 1 mile from Race Point, with the highest hill near the middle of the island bearing about 128° true (E by S mag.). The current is strong here throughout the flood, but the ebb current has little velocity and after the first 2 hours of ebb is nearly slack. With fresh southwesterly, northwesterly, or northerly winds the anchorage is untenable, as a rough sea and tide rips prevail.

Fire Island is joined to **Point Campbell** by a flat, bare at low water. A flat, bare at low water, fills the bight on the west side of Fire Island and extends about ½ mile northwestward from Fire Island light, at the southwest end of the island.

There is a sand shoal or bar about 2 miles northward of Fire Island on the crest of which the least depth found is 17 feet. Having in mind the difficulties of navigation due to strong currents and swirls, vessels will find it difficult to avoid the shoal places in the absence of aids. With the minus tides, and especially with strong northerly winds, the low tides may fall as much as 6 feet lower than the plane of reference, and vessels of more than about 10 feet draft should wait for sufficient tide to insure a safe passage at lowest tides.

Knik Arm has sufficient depth for deep-draft vessels, with the exception of the bar at its entrance which is mentioned in the preceding paragraph. The generally used anchorage is in the bight between **Woodrow Creek** and **Cairn Point**, 3 miles northeastward of Point Mackenzie, where good depths extend fairly close to the shore. Toward Cairn Point, anchorage can be selected in as little as 8 fathoms at low water; toward Woodrow Creek, the anchorage depths are greater. Vessels anchored close in avoid the strongest currents, which have an estimated velocity of 4 knots or more at strength in the middle of the arm. The currents, however, are so strong that vessels should use a long scope of chain, and they will generally foul the anchor if remaining over two tides. Chart 8557 is the best guide.

Woodrow (Anchorage post office), near the mouth of Woodrow Creek, is a town of about 3,000 inhabitants. It has a post office, general stores, and is a port of call for all steamship lines making Cook Inlet.

The local headquarters for the construction of the government railroad around Turnagain and Knik Arms are located here. Blacksmith and machine shops are maintained. There is communication with Seward by telephone and telegraph. There are at present no wharves to which vessels may go; freight is handled by means of lighters.

Goose Bay is a slight indentation on the west side of Knik Arm, 7 miles above Cairn Point. A cannery is located here, with a wharf having a depth at the end of about 30 feet at low tide. The channel is narrow here, and the currents are very strong; in making the wharf a vessel should first drop an anchor and swing to it.

From a point about 5 miles above Cairn Point the head of the arm is obstructed by extensive mud flats which bare soon after high water. These flats are cut by numerous channels and sloughs leading from the various streams. The main channel to the head of the arm lies close to the west shore at the point just above Goose Bay, thence diagonally outward to the middle of the arm, and up the middle to the head. It is narrow and intricate, navigable only on the tide, and then only with local knowledge.

Knik is a village on the western side of the arm, about 15 miles above Point Mackenzie, to which small craft go at high water and lie on the bottom at the ends of the landings at low water. Above Goose Bay, the channel to Knik lies close along the western shore. This channel is said to be filling in at present.

WESTERN SHORE OF COOK INLET.

On the western side of Cook Inlet, from Cape Douglas to Chisik Island, the mountains generally rise abruptly from the water, and Iliamna and Redoubt Volcanoes tower well above the surrounding peaks, affording excellent marks from all parts of the lower inlet. Northward from Redoubt Volcano the higher snow-clad peaks trend away from the inlet, passing through the lofty Mount Spurr.

Kamishak Bay is not surveyed southward of Rocky Cove and Augustine Island. Its south and west sides are said to be occupied by a flat as shown on the chart, and it is probable that there are numerous bowlders. The shore is mountainous, with cliffs and slides in many places, and there is no timber except at the north end of the bay. From Iniskin Bay to Chinitna Bay the lower lands are about half wooded. There are sand beaches in the bights and bays, which are covered, however, at high water.

Kamishak Bay is characterized by bowlders, which can be seen strewn along the shores and extending off toward the deeper water. So far as surveyed the shoaling is abrupt on approaching the reefs which fringe the shores, and the lead will not serve as a guide to clear them. Vessels should proceed with caution where the depths are not more than about 3 fathoms greater than the draft, as there are probably bowlders on the bottom. An unsurveyed bank, on which 4 fathoms was obtained, extends over 3 miles westward from Augustine Island. Owing to the probability of bowlders, vessels should

not pass westward of Augustine Island, and great caution should be exercised if attempting to pass south of the island.

Augustine Island, about 7 miles in diameter and 3,970 feet high, is a volcanic, conical peak from the crater of which steam is frequently discharged. The shore is low with bluffs in places, and is generally strewn with bowlders. A bowlder reef extends about ¾ mile off the northwestern half of the island as shown on the chart, and this area has not been closely developed. The north end of the island consists of numerous small mounds of bowlders with sloughs between. The west end is detached from the main island by a lagoon, the entrances to which are partly blocked by bowlders. The lower parts of the island are covered with brush and alder.

The surveying vessel anchored in the bight on the southwest side of Augustine Island. There are no bowlders on the beach and it seemed clear; it affords shelter in northerly and easterly winds. The vessel approached the anchorage on a 65° true (NE ⅜ N mag.) course for the volcano, and anchored in 6 fathoms, sandy bottom, about ¾ mile from shore.

The surveying vessel also anchored about 1 mile off the northwest side of Augustine Island, with the volcano bearing 135° true (ESE ⅛ E mag.) and the north tangent of the island bearing 75° true (NE ½ E mag.) in 8 fathoms, sandy bottom. Care should be taken not to get nearer the island, as there are numerous bowlders. It is exposed to northerly and northeasterly winds.

Augustine Rocks lie 8 miles 168° true (SE ¾ S mag.) from the peak of Augustine Island, and approximately 5½ miles from the shore of the island. They are two flat rocks, with a smaller one between them, all covered at high water. Their position is said to be generally indicated by kelp or breakers.

Bruin Bay is obstructed by numerous bowlder reefs and is not available as an anchorage. The upper end is bare at low water.

Rocky Cove is obstructed by reefs, bare at lowest tides, which extend 2 miles offshore.

Ursus Cove is exposed to a heavy swell in easterly weather, and the bottom is very broken.

Iliamna Bay (chart 8665) is in the northwest corner of Kamishak Bay about 15 miles 347° true (NW ¾ N mag.) from the peak of Augustine Island. It is 1 mile wide at the entrance and wider inside, and has a length of about 5 miles to its northern end and to the head of its western arm, called **Cottonwood Bay.** The greater part of the bay is filled by a flat, but there is good anchorage just inside the entrance. The shores are mountainous and there are no trees except the cottonwoods on the flats at the heads of the bay.

From the small native village in the cove 1 mile from the north end of Iliamna Bay, a trail about 12 statute miles long leads to **Iliamna,** a village on a river of the same name 4 miles from Iliamna Lake. The summit of the pass is about 3 miles from the bay and has an elevation of about 900 feet. From Iliamna village boats up to about 3 feet draft can be taken through Iliamna Lake and Kvichak River to Bristol Bay. See also Iliamna Lake and Kvichak River.

White Gull Island, grass-covered and about 70 feet high, is conspicuous near the middle of Iliamna Bay just inside the entrance. There is a depth of 7 fathoms in the entrance north of White Gull

Island, and the deepest water extends diagonally across to the entrance of Cottonwood Bay, where the depth is 12 feet. Anchorage in 4½ to 5 fathoms, soft bottom, may be had ¾ mile inside the entrance, with the northern side of White Gull Island in range with the south point at the entrance, and the north point at the entrance bearing 106° true (E ¾ N mag.). The anchorage is exposed to east and southeast winds and there are heavy williwaws with westerly winds, but it is regarded as secure during the summer.

In the approach to Iliamna Bay the depths are 6 to 8 fathoms several miles from shore, and these depths extend close to Turtle and Black Reefs so that the lead will not serve as a guide to clear them. Enter the bay on a 305° true (W by N mag.) course, passing between the north point at the entrance and White Gull Island, favoring the point slightly, and anchor ¾ mile inside the entrance. When in the bay the lead is a good guide, but care must be taken to avoid a reef, partly bare at low water and with 2½ to 3 fathoms close-to, which extends ⅜ mile eastward (true) from the south point at the entrance to Cottonwood Bay.

Turtle Reef extends over ⅜ mile eastward (true) from the south point at the entrance of Iliamna Bay. The reef is largely bare at low water, and is about 15 feet high at its highest point.

Black Reef lies over ½ mile from shore and 1⅛ miles 93° true (ENE ⅛ E mag.) from the northern point at the entrance of Iliamna Bay. The highest part of the reef is two rocks 5 to 10 feet high. Lying ½ mile northeastward of Black Reef is another reef which covers at half tide and extends ½ mile from shore.

It is reported that Iliamna Bay does not freeze, but that drift ice in large quantities sets in at times from the upper inlet. Fresh water may be obtained from streams on the northeast side about 1 mile inside the entrance. Northerly gales prevail in winter, and heavy williwaws are reported to come from the mountains on the northeast shore. The prevailing summer winds are down the bay, and are frequently fresh, especially on bright days.

The tidal currents at the anchorage have an estimated velocity of 1 to 2 knots.

Iniskin Bay is a secure harbor in any weather, although subject to some williwaws from the mountains on the west shore. The west shore is formed by sharp, bare peaks about 2,900 feet high, while the eastern shore is generally low and alder-covered. The western side and upper part of the bay are filled with bowlder-strewn flats bare at low water, and the eastern part is shoal and fringed by a reef. The channel is nearly ¾ mile wide at the entrance and tapers to a narrow slough at the head.

To enter Iniskin Bay, avoid the reefs which rise abruptly from deep water and extend about 1 mile from the shore eastward of the bay. Keep White Gull Island bearing northward of 278° true (WSW ⅝ W mag.), and pass over 1 mile southward of the outer islands off the entrance. When the two prominent headlands on the west side of Iniskin Bay, 1½ and 4 miles inside the entrance, are in line steer this range, course 14° true (N ⅞ W mag.) until approaching the western shore. Follow this shore at a distance of ¼ mile until Range Peak, on the north side of Right Arm, is in line with Iliamna Volcano, and then steer this range, course 26° true (N ⅛ E mag.). Anchor on the range, from 1½ to 2½ miles

above Scott Island, in 7 to 8 fathoms, muddy bottom, where the width of the channel between the 5-fathom curves is about 700 yards.

Water can be obtained from the streams in Iniskin Bay, the most convenient to the anchorage being a stream on the west side about 2 miles above the entrance. The tidal currents at the anchorage have an estimated velocity of about 2 knots at strength, setting fair with the channel.

Iniskin River, at the head of Iniskin Bay, is navigable for boats of not more than 3 feet draft for a distance of about 2 miles above the entrance.

Three small islands with outlying reefs lie on the east side of the entrance of Iniskin Bay. The northerly one, called **Scott Island**, is about 40 feet high and partly wooded, and from it a reef with rocks about 15 feet high extends ½ mile northwestward. The middle island is about 35 feet high, and from it a reef extends ¾ mile southwestward. The outer island is 50 feet high on the north side, and from it a reef partly bare at low water extends ½ mile southwestward; lying 1 to 1¼ miles southwestward from the islet is a sunken reef with little depth, which does not break in heavy weather. These reefs rise abruptly from depths of 7 to 8 fathoms, and the lead will not serve as a guide to clear them.

From **Iniskin Bay** to **Oil Bay** the coast is fringed by a reef, which extends about 1 mile from shore and rises abruptly. Many of the rocks show at low water. **Pomeroy Island**, 2¼ miles eastward of Scott Island, is small and rocky and has a few trees on its west end. A large rock about 10 feet high lies 1 mile eastward of Pomeroy Island. From Iniskin Bay to Oil Bay there is a comparatively smooth passage for launches inside the reefs.

From Oil Bay to **Chinitna Point** reefs extend about 1 mile from shore in places and rise abruptly from deep water. Rocks show at low water close to shore only. With northerly winds small boats can get some shelter in Oil Bay, Dry Bay, and the small bight under Chinitna Point.

Oil Bay is a shoal open bay having a sand beach at its head, which bares ¾ mile from shore. The bottom is rocky and broken, and is foul for about 1 mile offshore on the west side of the entrance. Abandoned oil wells are located in the valley of Bowser Creek about 2 miles from the head of the bay. From Oil Bay a valley leads through to Chinitna Bay and there is a good trail to Iniskin Bay along the north side of Mount Pomeroy.

Dry Bay is a rocky, shoal bight between Oil Bay and Chinitna Point. The head is a sand beach, on the eastern end of which is a cabin of an abandoned oil company.

Chinitna Bay is shoal, and an anchorage in 4 to 5 fathoms in the entrance is exposed to all easterly winds. The bottom is muddy and good holding ground, and anchorage can be selected anywhere in the bay where there is sufficient depth to lie afloat at low water. A small vessel of less than about 12 feet draft can anchor with fairly good shelter in a depth of about 18 feet in a narrow channel 300 yards northwestward of the low point on the south side 3 miles above the island in the entrance. There are strong williwaws with westerly winds. The bay is reported to be full of ice during the winter. The tidal currents rarely exceed 1¾ knots in the bay.

A prominent, rocky, grass-covered island, about 140 feet high, lies on the south side in the entrance of Chinitna Bay. Reefs extend 5/8 mile northward, northeastward, and southeastward from the island. A deep channel 3/8 mile wide leads into the bay southwestward of the island, but the main entrance is northward of the island and surrounding reefs as shown on the chart.

From Chinitna Bay to the prominent waterfall 5 miles southward of Chisik Island, the coast is low and wooded, with lagoons and marshes in places, and there is some quicksand. Thence into Tuxedni Harbor the coast is rocky bluffs and rises quickly to high land.

An extensive shoal, apparently an old glacial moraine, with rocky, very irregular bottom and indications of bowlders, extends 6 miles from the west shore between Chinitna Bay and Tuxedni Harbor. The least depth found is about 3¾ fathoms, but there is probably less. Deep-draft vessels should avoid areas with depths less than 10 fathoms. Tide rips mark the shoal at all times except at slack water, and are dangerous at times for small craft in heavy weather; the heaviest rips are near the extremity of the shoal, about 6 miles from shore.

Iliamna Volcano, 10,017 feet high, is an important mark. Steam generally issues from fissures just below the summit and from one of the lower peaks on its southeast slope.

Chisik Island is a narrow ridge, about 5 miles long and comparatively smooth on top, that slopes gradually upward from the southeast end of the island to its northwest end, where it terminates in a cliff, 2,678 feet high, which is a conspicuous mark. A reef extends about ¼ mile southeastward from the southeast end of the island.

Tuxedni Harbor, on the southwest side of Chisik Island, is a large and secure anchorage. Heavy williwaws occur with gales from any direction, and raise a choppy sea in the harbor dangerous to open boats. There is a cabin on the sand spit on Chisik Island 4 miles from its southeast end. Water can be had from a fall 5/8 mile northwestward of the cabin. The harbor is reported to be blocked with ice from December to March.

To enter Tuxedni Harbor give the southeast point of Chisik Island a berth of over ½ mile, keep in mid-channel until about 2 miles inside the entrance, and then follow Chisik Island at a distance of ½ mile. The anchorage is about 3/8 to ½ mile from Chisik Island for a distance of 1 mile below the cabin, in 15 to 17 fathoms, sticky bottom, and has a clear width of ¾ mile. On the island side the shore is bold, but a shoal makes out 5/8 to 1 mile from the main shore abreast the anchorage; the shoaling is abrupt on the sides of the channel and there are bowlders in places on the shoals. The passage northward of Chisik Island should be avoided, even by small craft.

Current.—The tidal current sets fair with the channel, and turns from ½ to 1 hour after high water. The ebb runs about 2 hours longer than the flood. The maximum flood and ebb currents observed was 1.7 and 2.2 knots, respectively.

From Tuxedni Harbor to Harriet Point the shore is a gravel bluff with trees on top and a few bowlders in the water. The point 8 miles southward of Harriet Point is an alder-covered bluff from 200 to 300 feet high, with a number of bare slides. There are bowlders in places

on the shoals which fringe this shore, and vessels should proceed with caution when inside the 10-fathom curve.

Redoubt Volcano, 10,198 feet high, is an important mark, lying 12 miles from the shore westward of Harriet Point. There is a notch on its southeast slope just below the summit.

Double Peak, lying 15 miles northward of Redoubt Volcano, is 7,088 feet high, has two knobs on top, and is easily identified from the inlet.

Harriet Point is a clay bluff about 100 feet high, with bowlders at the water. A bowlder reef bare at low water extends ¾ mile eastward from Harriet Point, and the point should not be approached closer than 1½ miles on the line of the reef.

There is a fair anchorage in moderate weather on the north side of Harriet Point, which so far as known is safe during the summer except for southerly, southeasterly, and northeasterly gales. Very small vessels can anchor in about 5 fathoms, about ½ mile from shore, with the point bearing 177° true (SSE ½ E mag.). At the anchorage the ebb current has a velocity of 2 to 3 knots, while the flood current is weak and of short duration.

From **Harriet Point to West Foreland** the shore is generally low and backed by patches of woods, which appear continuous, and is subject to overflow at extreme high tides. It is fronted by a flat which extends off a greatest distance of 2½ miles in the bight northwestward of Harriet Point and at the north end of **Redoubt Bay.** The edge of the flat is generally steep-to, but no bowlders were seen on those parts lying in front of marshy shores. Drift River is shallow, rapid, and obstructed by rocks and snags.

Butte is a prominent wooded hill 488 feet high, lying 4 miles inland and 14 miles southwestward of West Foreland.

Kalgin Island is 11 miles long, over 200 feet high at its north and south ends, and wooded. The entire island is fringed with bowlders.

A shoal extends 16 miles southward from Kalgin Island. There are spots bare at low water for a distance of nearly 8 miles from the island, and thence southward the least depths found are 9 and 14 feet. It is apparently a part of an old glacial moraine, the bottom is very broken, and there are probably less depths than found by the survey, especially between the shoaler lumps. No bowlders show at low water, however, on the shoal except near the island. The shoaling is abrupt on the sides of the shoal from depths of 15 to nearly 40 fathoms, as shown on the chart. There is a 5-fathom spot close to the 10-fathom curve at the south end of the shoal which lies 110° true (E ½ N mag.) from the peak of Chisik Island.

A passage with general depths of 12 to 15 feet, which is used by cannery tenders, leads across the shoal from 1 to 2½ miles southward of Kalgin Island, as shown on the chart. A range should be picked up in the opening northward of Chisik Island to insure making the course good, as the currents on either side of the island have a velocity of 3 to 4 knots at times, and are nearly slack in the lee of the island. There are bowlders near Kalgin Island, and they may also exist in the passage.

A sand shoal or ridge about 8 miles long lies 2½ to 3½ miles westward of Kalgin Island. It shows about 7 feet above mean lower low water at the highest point near its middle. The shoaling is abrupt on the sides of the shoal.

A bowlder-strewn shoal with depths of 7 fathoms or less extends 8 miles northward from the northeast point of Kalgin Island. The area has been gone over at a good low water, and the outer bowlders which show at low water lie 2½ miles from the island in depths of nearly 30 feet. As there may be other bowlders not found, it is advisable to proceed with caution where the depths are not more than 30 feet greater than the draft.

Small vessels can select anchorage off the middle of the north end of Kalgin Island, with good shelter from southerly gales drawing up the inlet. The holding ground is good and the currents as little as will be found at any of the exposed anchorages. Caution must be observed, however, at low water when crossing the broken, bowlder-strewn area with depths less than 7 fathoms making off from the north end of the island.

The highest parts of the shoal lying between Kalgin Island and West Foreland show between 3 and 4 feet at mean lower low water. Although the bottom is rocky in places, there are no bowlders showing in its vicinity at lowest tides. There are bowlders in places on the bottom between the shoal and West Foreland.

West Foreland is a flat wooded headland 262 feet high, with a bluff at the water. The shore at West Foreland and for a distance of 4 or 5 miles northward is fringed with bowlders, which extend below low water. The bottom is broken and there are bowlders between West Foreland and the shoal southward.

Kustatan River has its entrance 3½ miles westward of West Foreland. It connects inland with **McArthur River**, which enters the inlet 12 miles northward of West Foreland, and this route is used by the natives in bidarkas when going to Tyonek.

For a distance of 8 miles northward from West Foreland the bluff is at the water and there are numerous bowlders on the beach. The bluff then trends inland to a conspicuous wooded ridge, 5 miles long and 300 feet high, which is 2½ miles inland at its northern end.

For a distance of 15 miles northward from the end of the bluff the shore of **Trading Bay** is flat, grass covered, and subject to overflow, and there are several sloughs. This part of the bay is fronted by a flat which extends off a greatest distance of 2⅛ miles at the mouth of McArthur River. This river is about 1 mile wide at its entrance at high water, but due to a bar across its mouth it can not be entered at low water.

Nikolai River is a narrow slough 19 miles northward of West Foreland. There is a depth of 1 to 2 feet at low water in the channel across the flat which extends upward of 2 miles from shore. A depth of about 15 feet can be taken into the river at high water. The water in the river is fresh nearly to its mouth except for a short time at high water.

Beginning at a prominent gulch 2¾ miles northeastward of Nikolai River the bluff comes to the shore and so continues around North Foreland. The gray bluff just eastward of the gulch is a prominent feature. There is a small stream in the gulch. Anchorage can be had about ¾ mile off the gulch, in 4 to 5 fathoms, hard bottom, with the village of Tyonek open about 100 yards from the grayish bluff point eastward of the anchorage. Rocks awash at low water extend ¾ mile from shore 1 mile eastward of the gulch.

Old Tyonek is a small native village 6½ miles northeastward of Nikolai River. For a distance of 1 mile westward of Old Tyonek there are several large bowlders ¾ mile from shore. Thence eastward the shore is clearer.

Tyonek is a native village on a grassy spit on the southeast side of North Foreland 3 miles eastward of Old Tyonek. Anchorage can be had about 300 yards off the eastern end of Tyonek, with the Greek church bearing about 4° true (NNW mag.), in 4 to 5 fathoms, mud and gravel. The flood current has a velocity of 4 to 5 knots, and ebb 2 to 3 knots. Care should be taken to avoid a shoal bare at low water which lies about 250 yards westward of the anchorage and extends 100 yards from shore. The anchorage is good during moderate weather or with offshore winds.

North Foreland is a bluff about 150 feet high at the end of a hilly, wooded ridge. Thence northward the bluff is lower.

Chuit River, about 3 miles northward of North Foreland, is marked by a low break in the bluff. A depth of about 8 feet can be taken into the mouth of the river at high water, and the tides are felt about 1 mile up the river. **Ladd** is a small native village and a large warehouse on the north side at the mouth of the river.

There is a prominent bluff 150 feet high on the south side of **Threemile Creek.** The bluff continues northward for 2½ miles from this creek, and then the tree line is from 2 to 3 miles inland from ordinary high-water mark, the strip between being subject to overflow at extreme high tides. This feature continues to within 2 miles of Point Mackenzie.

Beginning at Threemile Creek the shore is fronted by a mud flat which extends off an increasing distance from the shore northward. Its low-water edge is about 2 miles off the mouth of Beluga River, 5½ miles off the mouth of Susitna River, 3½ miles off the shore eastward nearly to Little Susitna River, and extends to the shore about 1 mile westward of Point Mackenzie.

Beluga River is 11½ miles northward of North Foreland. The channel through the flats at the mouth of the river has a depth of about 2 feet or less at low water, and is said to shift in the winter and spring from the action of ice. A depth of as much as 18 feet at high water can be carried to **Beluga**, a former trading station, about 2 miles above its entrance, where the depth is not over 8 feet at low water. The effect of the tide is felt in the Beluga River 6 or 8 miles from its mouth, and it is said that boats can ascend to **Beluga Lake**, about 20 miles inland.

Theodore River, 3½ miles northward of Beluga River, is similar to Nikolai River. About 3 or 4 miles up Theodore River it reaches to within ¾ mile from Beluga River, and there is an easy portage between.

Lewis River, 3 miles northward of Theodore River, is a slough draining the marshes.

Susitna River is navigable for stern-wheel steamers of 2 or 3 feet draft to the **Talkeetna River**, a distance of about 68 nautical miles, but this was done only at good stages of high water and presented many difficulties; under the most favorable conditions of very high water a steamer has been taken to **Indian Creek**, about 100 miles from the mouth. Launches occasionally run up the **Yentna River** to the forks, about 65 nautical miles above its junction with the

Susitna. The tides are not felt more than 7 miles up the Susitna, and above this the current is swift.

The channels across the flat at the mouth of the river have depth of about 2 feet or less at low water. They change during the winter and spring, due to the action of ice and freshets, and the channels in and above the entrance are said to change frequently in the spring and early summer.

Susitna, the principal base of supplies, is on the Susitna about 18 nautical miles above the entrance and just below the mouth of the Yentna. The principal traffic is in launches, occasionally towing scows, which run from Knik Arm to Susitna.

Little Susitna River, about 9 miles westward of Point Mackenzie, is reported to be navigable for launches at high water for a distance of 8 miles.

Susitna Mountain, the prominent mark in the upper inlet, is 4,401 feet high and lies on the west side of Susitna River, 13 miles above the head of Cook Inlet. A high ridge extends off from it in a westerly direction.

KODIAK AND AFOGNAK ISLANDS.

This group, lying southwestward of Cook Inlet, and separated from the mainland by Shelikof Strait, consists of the two large islands above named, and numerous small ones along their shores. The group is about 155 by 54 miles in extent, with its greatest length in a southwesterly direction.

The land is rugged and mountainous, with elevations of 2,000 to 3,000 feet along the shores, and in excess of 4,500 feet in the interior. The shores are rugged and rocky, and are indented by numerous deep narrow inlets, in which are numerous rocks and reefs.

The eruption of Katmai Volcano in 1912 covered this group with a thick deposit of volcanic ash. This ash is now rapidly disappearing, but at present (1916) vessels approaching to the leeward of the islands in thick weather with any breeze will be warned of their proximity to the land by the presence of this volcanic dust in the air.

This region is one of the important centers of the salmon canning industry. Previous to the eruption there was also considerable cattle raising, and this is now being resumed on a smaller scale. Some mineral prospects have been located.

EAST COAST OF SHUYAK AND AFOGNAK ISLANDS.

Shuyak Island is generally wooded and hilly, with elevations probably above 1,000 feet. Some of the hills on the island, and the outlying islands and rocks on its northern and western sides, are located. The island is deeply indented by inlets, but no information is available respecting them.

Point Banks is an island about ¾ mile long close to the northeast end of Shuyak Island. A rock about 20 feet high lies ½ mile northwestward of Point Banks; no breaker was seen outside of the rock at low water with a moderate swell.

Perevalnie Island is close to the northern shore of Shuyak, its western end lying 1⅞ miles southwestward of the rock northwestward of Point Banks. Temporary anchorage for a small vessel, sheltered from southeasterly winds, can be had in the western entrance of the

narrow passage between Perevalnie and Shuyak Islands, in 10 fathoms muddy bottom. There is no shelter in northeasterly weather, and it is a bad place to leave on account of the heavy sea and tide rips.

The northern side of Shuyak Island westward of Perevalnie Island is apparently foul, rocks awash and sunken extending well off in places. The western coast of Shuyak Island is described on page 125.

Sea Otter Island, lying 7½ miles southeastward from Point Banks, is grass covered, ⅜ mile long, and about 100 feet high. It is surrounded by bare rocks and breakers to a distance of 1½ to 2 miles.

Afognak Island is in its eastern part a series of mountain ridges with low depressions between them running through the island from north to south. From a distance Marmot Island shows as the easternmost of these ridges. The lower parts of Afognak Island are wooded, except its eastern coast, and its southwestern end southward of Paramanof Bay. The northern part of the island between Black Cape and Tonki Cape is not surveyed.

Tonki Cape is the northern end of the high ridge separating Tonki Bay from Marmot Strait. It is about 100 feet high and grass covered, and rises gradually southward to high land. A short reef with some large bare rocks on it extends northward from the cape, terminating in a rock, bare at low water, ¼ mile from shore. Temporary anchorage in southeasterly weather can be had by a small vessel off the bight on the west side of the end of Tonki Cape.

Tonki Bay, on the west side of Tonki Cape, has two main arms. The eastern one is about 5 miles long from Tonki Cape. The arm is 1¾ miles wide abreast the headland separating the arms, which is 2½ miles inside Tonki Cape, and has a high rocky islet about ⅜ mile northward from it. Three rocks, covered at high water, lie about ⅜ mile from the eastern shore and 1¾ miles southward of Tonki Cape. The west side of the arm is steep and apparently bold; the east side is lower and more broken. There is anchorage about ¼ mile from the head of the arm in 10 fathoms, soft bottom, but it is not secure with northerly winds.

The western arm of Tonki Bay extends southward to within about 2 miles of Izhut Bay, with low land between. There is no bottom at 20 fathoms in mid-channel until ¼ mile from the beach in the bight on the eastern side ¾ mile from the head, where there is secure anchorage in about 12 fathoms, hard bottom.

The coast for 5 miles southward of Tonki Cape is a low bluff, with a marsh ¼ to ½ mile wide between it and the foot of the ridge which rises abruptly. Numerous islets and rocks fringe the coast, extending off ¼ mile in places. Thence southward the bluffs increase in height toward King Cove. Southward of King Cove the coast is a bluff over 500 feet high, which extends around Pillar Cape.

King Cove, lying 288° true (W ½ S mag.) from the south end of Marmot Island, is an open bight 1½ miles long and indents the coast ½ mile. It may be used as a temporary anchorage with offshore winds, and otherwise affords no shelter. There are numerous kelp patches in the cove near the shore.

Marmot Strait, between Afognak and Marmot Islands, is 2½ to 3 miles wide, and is frequently used by vessels. While no sounding has been done, it is apparently deep and clear in the middle. The shores are more or less foul and should be given a berth of over ¾ mile. The tidal currents have an estimated velocity of 1 to 3 knots,

the flood current setting northward. Sailing directions through the strait are given on page 27.

Sealion Rocks lie 5¼ miles east-northeastward from Tonki Cape and 4 miles northward from Marmot Island. They are two bare rocks, close together, the larger one about 40 feet high, and a reef, bare at low water, lying ⅝ mile northeastward from the bare rocks.

Marmot Island is about 6½ miles long, with elevations up to about 1,300 feet, and wooded to a height of about 500 feet. The north end is low and rises gradually to the high land. The eastern side and southern end of the island are bluffs over 500 feet high in places. The western shore is also steep but lower. There are three high rocks close to **Marmot Cape**, the south end of the island, and two close to its southeast side.

A rock about 6 feet high lies 600 yards from the northwest side of Marmot Island, about 1½ miles from its northern end. An extensive kelp field makes out from the island to a distance of about ½ mile northward from the rock, and extends around to the north end of the island.

Two sunken rocks, on which the sea generally breaks at low water, lie about 1 mile apart and 2½ miles eastward of **Cape St. Hermogenes**, the eastern end of Marmot Island. The northern rock lies 108° true (E ½ N mag.) from the north end of the island and 38° true (N by E ¼ E mag.) from its southeast end. The southern rock lies 120° true (E ½ S mag.) from the north end of the island and 45° true (N by E ⅞ E mag.) from its southeast end. The range of the two pinnacle rocks close to the southeast side of Marmot Island, bearing 232° true (SSW ½ W mag.), passes southeastward of both breakers.

Pillar Cape is a bluff over 500 feet high, similar to the southeast side of Marmot Island, and there is a high pinnacle rock at the foot of the bluff ½ mile eastward of the south end of the cape. On the southwest side of Pillar Cape are three high bluff points with small coves between. About 1½ miles westward of the cape is an open bight from which a low divide extends through to the western arm of Tonki Bay.

MARMOT BAY

extends westward between Afognak and Kodiak Islands to Whale Island. The route along the south side of the bay through Narrow Strait and Whale Passage is generally used by vessels from Kodiak bound to Shelikof Strait. These passages are described on pages 123–124.

The northern part of Marmot Bay is clear except its western end between Kostromitinof Cape and Hog Island. The outlying broken ground in the entrance and middle of the bay has not been closely developed. Pillar Cape may be rounded at a distance of 1 mile in depths of over 20 fathoms. Deep water extends as close as ¼ mile to Izhut Cape. In the western end of the bay danger will be avoided by keeping eastward of a line from the eastern end of Kostromitinof Cape to Stripe Rock, and eastward of this range extended southward, until Hog Island is open from the northwestern side of Whale Island.

Izhut Bay has its entrance between Pillar Cape and Peril Cape, and extends into Afognak Island about 7 miles in a northwesterly direction with a width of 3 miles in its lower part. No dangers were seen in the bay, but it has not been sounded and kelp extends a short dis-

tance off all the points. The shores are wooded and water may be obtained from numerous streams.

The southern arm on the western side of Izhut Bay has its entrance 3 miles inside Peril Cape, and is about 3 miles long in a 316° true (WNW mag.) direction with a width of about ¾ mile. Lying 1½ miles inside the entrance of the arm there is an islet with a rock, bare at low water, 50 yards off its southern side. The surveying vessel used the channel southward of the island. Just above the island the arm contracts to ¼ mile and then expands into a basin about ¾ mile in diameter. There is a rock, bare at low water, close to the north point at the entrance of the basin. Secure anchorage can be selected in the basin. A stream enters on its southern side.

At the northern end of Izhut Bay is the entrance to two small arms, about ¼ mile off the western point of which is a prominent, steep rocky islet about 60 feet high. The eastern arm has an islet in it, the channel being eastward of it; there is secure anchorage for a small vessel above the islet in 7 to 9 fathoms. The western arm is straight and clear, and has secure anchorage about ½ mile from the head in 9 fathoms. A mid-channel course should be followed in the arms.

Peril Cape is a prominent, precipitous headland about 600 feet high, and there is a high pinnacle rock close to its southern side.

Izhut Cape, lying 2½ miles southwestward of Peril Cape, is a projecting, long, wooded, hilly point from 250 to 500 feet high. There is deep water around the cape as close as ¼ mile.

Duck Bay is about 6 miles long from Izhut Cape to Kostromitinof Cape. At the eastern end of the bay temporary anchorage may be had in the middle of the cove 1½ miles northwestward of Izhut Cape, in 6 to 7 fathoms. The anchorage is eastward of an islet, about 30 feet high, which lies ¼ mile from the northern shore and should not be approached closely.

A round, rocky island, 160 feet high and grass covered on top, lies 2½ miles westward from Izhut Cape and ¾ mile from shore. Kelp extends nearly ¼ mile westward and northward of the island, and numerous bare rocks extend ½ mile eastward of the island and to the shore northeastward of it. In the cove northward of the island is a small native settlement. Temporary anchorage may be had in the middle of the cove, in 10 to 12 fathoms. Enter the cove westward of the island, between it and a large rock, awash at high water, lying ¼ mile southward from the western point of the cove.

The next cove westward having its entrance 1 mile northwestward of the island, is 1 mile long and ¾ mile wide. The bottom is rocky and kelp extends some distance from shore in places. Small craft, entering with care, can anchor in 5 to 8 feet of water at the head.

Kostromitinof Cape is a projecting, long, level, wooded point, about 200 feet high, with bluffs in places at the water. Northward from the cape the land rises gradually in a distance of 5½ miles to a prominent peak 2,080 feet high.

Spruce Island, on the south side of Marmot Bay, has generally a low, wooded strip all around it, but the middle of the island is a grassy ridge 1,580 feet high, with but few trees. **South Point** of the island is marked by a high, black, rocky islet, with a lower one close to its south side, lying 600 yards southward from the point. **East**

Cape has some large bare rocks close-to, and broken ground, with 8 fathoms on it and a possibility of less, extends 1½ miles northward from it. **North Cape** is a wooded knob 550 feet high. There is a high, wooded island close to the western end of Spruce Island.

The Triplets, lying 1½ miles westward of North Cape of Spruce Island, are three grass-covered islands, the highest 190 feet. The group forms a chain 1 mile long, and there are bare rocks between them. The 14-fathom soundings lying nearly 1 mile and 2⅜ miles northward of The Triplets, and the 25-fathom sounding lying midway between The Triplets and Kostromitinof Cape, have not been developed.

Whale Island, at the western end of Marmot Bay, is about 4 miles in diameter. Its southern half is a grass-covered mountain 2,030 feet high, with a narrow, light streak or landslide down its eastern slope. The northern side of the island is low, and the lower parts of the island are generally wooded. **Treeless Islet**, rocky and grass covered, lies ⅜ mile off the eastern side of the northern end of the island. Whale Passage is southward of the island and Afognak Strait northward.

DANGER BAY,

on the north side near the western end of Marmot Bay, has its entrance between Kostromitinof and Kazakof Capes, where it is 2¼ miles wide, and extends 6 miles 4° true (N by W ¾ W mag.) to its head, where it is 1 mile wide. From the head of the bay two narrow arms extend northward, the western one 1 mile long and the eastern one 2 miles.

Parrot Islet, round, rocky, and 30 feet high, is in the entrance of the bay and ¾ mile westward of Kostromitinof Cape. Broken ground, on which are several rocky islets and rocks awash, extends southward from the islet to two rocks bare at low water lying ½ mile 171° true (SE by S mag.) from it.

A sunken ledge, with some kelp and on which the least depth found is 22 feet, lies ¾ to 1½ miles 143° true (SE by E ½ E mag.) from Parrot Islet, and its northern end lies ½ mile southwestward from Kostromitinof Cape.

Stripe Rock, lying off the entrance of the bay 2⅞ miles 190° true (S by E ¼ E mag.) from Parrot Islet, has two pinnacles, close together and about 35 feet high, the higher one having a prominent white streak for its entire height. There are some smaller rocks near them, and two rocks, covered at high water, lie ⅜ mile northwestward from the pinnacles.

A large bare ledge about 30 feet high lies 1 mile north-northwestward from Stripe Rock. From this ledge and Stripe Rock to the islands and Skipwith Reefs off the eastern entrance to Afognak Bay, the area is foul, having numerous reefs and kelp patches, and should be avoided by vessels.

On the eastern side of Danger Bay, 3¼ miles northward of Parrot Islet, there is a cove which affords anchorage for a small vessel, in 12 to 14 fathoms, and small craft can anchor in its southeastern end in about 5 fathoms. A reef extends about 100 yards off the south side just inside the entrance of the cove, and the small bight in its eastern side is shoal.

A bare rock, a few feet high, lies ⅜ mile from the eastern shore and ⅝ mile from the head of the bay. Vessels of any size can anchor about midway between this rock and the point separating the two arms at the head, in 14 to 15 fathoms, muddy bottom. Small vessels can anchor, in 8 to 10 fathoms, either in the broadest part of the western arm ¼ mile from its head, or in the entrance of the eastern arm.

DIRECTIONS, DANGER BAY.

From eastward, shape the course for a position about ½ mile southeastward of Kostromitinof Cape. Then steer for Parrot Islet on a 305° true (W by N mag.) course until the southwestern end of the cape is a little forward of the beam. Then steer 333° true (NW ½ W mag.) and pass ¼ mile off the southwestern end of the cape and the same distance northeastward of Parrot Islet.

Then steer 359° true (NNW ¼ W mag.) with Parrot Islet astern, which will lead to the head of the bay. Above Parrot Islet there are no dangers if the shores be given a berth of ¼ mile, except the bare rock lying ⅜ mile from the eastern shore and ⅝ mile from the head of the bay.

From southwestward, keep Hog Island open from the northwestern side of Whale Island until Stripe Rock is in range with the eastern side of Kostromitinof Cape. Then steer 41° true (N by E ½ E mag.) for 2¼ miles to a position ¼ mile eastward of Stripe Rock. Then steer 6° true (N by W ⅝ W mag.) for 1⅛ miles to a position ¼ mile eastward of a bare ledge about 30 feet high. Then steer 333° true (NW ½ W mag.) about 1 mile. Then steer 358° true (NNW ¼ W mag.) for ¾ mile, keeping Stripe Rock open westward of the bare ledge (about 30 feet high) astern until Parrot Islet is ½ mile on the starboard beam. From this position a 5° true (N by W ⅝ W mag.) course will lead to the head of the bay.

AFOGNAK BAY,

making into Afognak Island from the western end of Marmot Bay, is a secure anchorage and easily entered in the daytime. It is 5 miles long from Hog Island, the entrance is nearly 3 miles wide between Big Rock and Afognak village, and above Dot Island the bay is ½ mile wide. On the western shore 1⅛ miles above Dot Island is a disused cannery, and at the head of the bay is a Government fish hatchery. The best anchorage is off the cannery in 8 to 10 fathoms.

The eastern side of the entrance is formed by a chain of islands and bare rocks. **Lamb Island,** nearest to the shore, is ½ mile long and wooded. **Alexander Island,** ¾ mile eastward of Lamb Island, is grass covered, and has a knob about 80 feet high at its north end. **Skipwith Reefs,** a chain of bare rocks, extend 1½ miles southeastward from Lamb Island to Big Rock. The southern side of the rocks should be given a berth of over ⅜ mile. The principal danger in the approach is a rock, awash at low water and steep-to, lying ⅝ mile 118° true (E ⅜ S mag.) from **Big Rock**; Hog Island open from the northwestern side of Whale Island leads ¼ mile southward of the rock awash, and Stripe Rock in range with the eastern end of Kostromitinof Cape leads ½ mile eastward of it. The better entrance to

the bay is between Big Rock and Hog Island, and has a clear width of over ½ mile.

Hog Island, the prominent mark in the entrance of the bay, is ⅜ mile long, and has two wooded knolls with a saddle between. Foul ground marked by kelp extends about 350 yards northeastward from its eastern end and 650 yards westward from its western end.

Afognak is a village with post office which extends along the western shore of the bay for a distance of nearly 2 miles northward of Head Point. The church (white with green roof) is the best mark in the village, and lies ¼ mile southward of Graveyard Point.

Village Reefs are partly bare at low water and covered with kelp, and extend over 1 mile eastward from Afognak toward Hog Island. The point of the reefs is midway between Graveyard Point and Hog Island. Southeastward from the point of the reefs is a detached shoal with a least found depth of 3½ fathoms. Between this shoal and the reef extending westward from Hog Island is a channel ½ mile wide.

Danger Reef lies 1⅛ miles 57° true (NE by N mag.) from Graveyard Point and 1½ miles 317° true (WNW mag.) from the west end of Hog Island. It is small, bare at half tide, marked by some kelp, and is a serious danger when covered.

A rock, with 14 feet over it and marked by kelp, lies ⅝ mile west-northwestward from Danger Reef and the same distance 52° true (NNE ½ E mag.) from Lipsett Point on the western shore.

Dot Island, small and wooded, is the western one of three small islands close to the eastern shore where the bay narrows to ½ mile. On the western shore opposite Dot Island is a cascade where fresh water can be obtained by boat.

For tides, see Afognak Strait.

DIRECTIONS, AFOGNAK BAY.

From eastward, keep Hog Island open from the northwestern side of Whale Island, bearing anything westward of 250° true (SW ⅛ W mag.) until about ¾ mile from Hog Island, to clear the dangers on the northern side of the approach. Then pass midway between Hog Island and Big Rock.

From Narrow Strait, follow the directions on page 123 until westward of Three Brothers. Then steer 328° true (NW by W mag.) for 6 miles with Low Island astern to a position ½ mile northeastward of Hog Island.

Pass midway between Hog Island and Big Rock and steer 315° true (WNW ⅛ W mag.) for the old cannery building showing midway between Dot Island and the eastern shore. Keep this range for about 2 miles until the western end of Lamb Island is abeam. Then steer 308° true (WNW ¾ W mag.) for 1¾ miles and pass 400 to 500 yards southward of Dot Island.

Keep this course for about ¼ mile past Dot Island until ¼ mile off the cascade on the western shore. Then steer 353° true (NNW ¾ W mag.), favoring slightly the western shore, for ¾ mile. Anchor near mid-channel off the old cannery in 8 to 10 fathoms. The anchorage is clear if Winter Island be given a berth of 300 yards and Last Point (on the north shore) 400 yards.

From Afognak Strait, steer for the south end of Hog Island with Deranof Rock astern, course 73° true (NE ⅜ E mag.) until ⅜ mile

past Dolphin Point (northeast end of Whale Island). Then steer for the western end of Lamb Island with the eastern end of Whale Island astern, course 8° true (N by W ⅜ W mag.) and pass ⅝ mile westward of Hog Island. When ½ mile past Hog Island and Big Rock is a little forward of the beam, steer 325° true (NW by W ¼ W mag.), heading for Dot Island with the western end of Hog Island astern, which leads nearly ¼ mile northeastward of Danger Reef. Keep this course for 2 miles until about ¾ mile from Dot Island, and then steer 308° true (WNW ¾ W mag.) and pass 400 to 500 yards southward of it. Then follow the directions in the preceding paragraph.

AFOGNAK STRAIT,

between Whale and Afognak Islands, is not generally used, but is convenient for small vessels when bound to or from Afognak Bay and the currents are only half as strong as in Whale Passage. With care the navigation is not difficult on a clear day when the marks for the strait can be seen. It has a least width of ⅝ mile, but large areas, especially on the north side, are foul and there are many dangers. The channel at Chiachi Point, where it is narrowest and shoalest, has a width of ¼ mile and a general depth of 24 feet, but there is a rock with 16 feet over it in mid-channel. The dangers are marked by kelp, which grows in depths up to about 6 fathoms and shows at slack water.

Dolphin Point is the northeast end of Whale Island. A reef partly bare at low water extends 600 yards from Whale Island at a point ¼ mile westward of Dolphin Point.

Fox Bay, the bight in Whale Island 1 mile westward of Dolphin Point, has a reef in its entrance which shows well at low water. A small vessel can anchor in the bay inside the reef in 4 to 5 fathoms, but the south shore must be given a berth of 300 yards. Thence westward the shore of Whale Island is clear to Chiachi Point, the northwest end of the island, from which a shelving reef makes out about 350 yards in a northwest direction.

In the narrowest part of Afognak Strait, for a distance of ¾ mile westward of Afognak village, foul ground extends ¼ mile from the north shore. Thence westward the northern half of the strait is foul. The principal danger is a reef awash at low water lying a little over ⅜ mile northwestward of Chiachi Point and 1¼ miles 69° true (NE mag.) from the south end of Deranof Island.

A rock with 16 feet over it lies ¼ mile eastward of the preceding reef, ⅜ mile 24° true (N mag.) from Chiachi Point, and on or a very little northward of the range of Deranof Rock and Kupreanof Mountain. The channel is southward of the rock and is about 300 yards wide.

Deranof Island, ½ mile long, low and wooded, is the southernmost and largest of the islands at the western end of Afognak Strait.

Deranof Rock, about 8 feet high, lies nearly 200 yards southward of the island. Broken ground with a least depth of 16 feet lies ⅜ mile eastward of the island and 74° true (NE ½ E mag.) from Deranof Rock.

Temporary anchorage may be had in the channel of Afognak Strait between Fox Bay and Afognak village, in 7 to 8 fathoms, but exposed to the full strength of the currents and to easterly and northeasterly winds. A small vessel can anchor in Fox Bay.

Small vessels can anchor near the kelp on Village Reefs, with the church (white with green roof) in Afognak bearing 344° true (NW ½ N mag.), and Head Point (south of the village) in line with Deranof Rock, in 5 fathoms. Little current will be felt here, but it is exposed to easterly winds.

With easterly winds small vessels can anchor about ¼ mile westward of the point on the north side of Afognak Strait ¾ mile westward of Head Point, in about 4 fathoms, but care is required. When rounding into the anchorage, pass northeastward of a reef, bare at low water, lying ⅜ mile southwestward of the point, and give the point a berth of over 300 yards.

Tides.—High and low water occur about 10 minutes later than at Kodiak, and the mean rise and fall of the tides is 8.1 feet. To find the approximate height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges 1.17.

The **tidal currents** in Afognak Strait set westward on the flood and eastward on the ebb. The estimated velocity is 2 to 5 knots at strength, depending on the range of the tide. Slack water occurs about 1 hour before high and low waters at Kodiak. During the flood there is a strong set into Raspberry Strait, which should be kept in mind when in the western end of Afognak Strait.

DIRECTIONS, AFOGNAK STRAIT.

From Narrow Strait follow the directions on page 123 to a position ¼ mile northward of Shakmanof Point. Then steer 313° true (WNW ¼ W mag.) for 5½ miles and pass ½ mile northeastward of Dolphin Point.

From eastward in Marmot Bay, keep Hog Island open from the northwest side of Whale Island, bearing anything westward of 250° true (SW ⅛ W mag.), and pass ¼ mile or more southward of Hog Island and ½ mile northward of Dolphin Point.

From Afognak Bay, steer 145° true (SE by E ¼ E mag.) for the western end of Hog Island with Dot Island astern, which leads nearly ¼ mile northeastward of Danger Reef. When Alexander Island is abeam, steer 188° true (S by E ⅜ E mag.) for the eastern end of Whale Island with the western end of Lamb Island astern, and pass ⅝ mile westward of Hog Island.

Passing ½ mile northward of Dolphin Point, steer for Deranof Rock in range with the summit of Kupreanof Mountain, or, if the mountain is hid, steer for Deranof Rock with the southern end of Hog Island astern, course 253° true (SW ⅜ W mag.). In the narrowest part of the strait for ¾ mile westward of Afognak village, go nothing northward of the range. When approaching the western end of the strait, keep a little southward of the range to avoid the rock with 16 feet over it, but give the shore of Whale Island a berth of over 300 yards; on the flood guard against a northerly set toward Raspberry Strait.

When the eastern one of the two highest peaks on the southern side of Whale Passage opens westward of Whale Island, bearing 184° true (S by E ¾ E mag.), steer 238° true (SW by S mag.) and pass ¼ mile southeastward of Deranof Rock. Continue the course ¾ mile past the rock, and then steer 286° true (W ¾ S mag.) with the summit of Whale Island astern. This course made good will lead

through Kupreanof Strait, passing ⅜ to ½ mile southward of Gori Point, ⅞ mile northward of Outlet Cape, and ½ mile southward of Malina Point.

CHINIAK BAY AND ST. PAUL HARBOR.

Chiniak Bay is the indentation in the northeast end of Kodiak Island between Cape Chiniak and Spruce Cape, and St. Paul Harbor is inside the islands on its northwest side. The harbor is not difficult of access in the daytime and clear weather, but the entire bay and its approaches are dangerous at other times, and the narrow channel leading to the wharf at Kodiak requires careful piloting. Kodiak Island is mountainous, while the shores and islands of the bay are comparatively low. The prominent features in the bay and approaches are:

Cape Chiniak, the southeast point of the bay, is low and wooded for ¾ mile back and then rises gradually to high land. A flat, wooded islet and numerous high, bare rocks extend 1⅛ miles northeastward from the cape.

Long Island, the easternmost island in the northern end of the bay, is 3½ miles long, about 250 feet high, hilly, with cliffs at the water, and wooded except toward its northern end. The northeast end is two grassy knolls joined by spits, and a high, steep, rocky islet lies 250 yards eastward of it. Extensive, kelp-marked reefs, with some high, bare heads, extend from ⅝ to ⅞ mile north-northeastward from the northern side of the island, and broken ground with a possibility of danger extends in the same direction beyond the reefs to a distance of about 2 miles from the island. The southeastern side of Long Island is fringed with rocks and kelp to a distance of ¼ to ½ mile from shore. There is a high pinnacle close to its south end, and a high grass-covered rock lies ⅜ mile eastward of the pinnacle and 300 yards from shore.

Woody Island, westward of Long Island, is 2½ miles long, 166 feet high, and heavily wooded. There is a native village, church, and boat landing on its western end. The naval radio station is located here.

Westward of Woody Island is a group of islands, of which **Holiday Island,** the northernmost, is 165 feet high and wooded. **Bird Islet,** close eastward of Holiday Island, is about 30 feet high and there is a bare rock close to its southern end. **Near Island,** the largest of the group, is 198 feet high and grass-covered.

Spruce Cape, the northwest point of the bay, is a low bluff, grass-covered on top and backed by woods. Bare rocks and foul ground extend ⅝ mile northward from the cape to **Hanin Rocks,** which are two masses about 30 feet high with an extensive surrounding ledge. A rock, bare at low water, lies 250 yards northward of Hanin Rocks, and Hutchinson Reef lies ½ mile eastward from them.

Miller Point, 1 mile westward of Spruce Cape, is partly wooded and terminates in a rocky bluff. High, bare rocks extend 300 yards off the cape, and three rocks, covered at high water, lie ⅜ to ½ mile northward of it.

Devils Prongs are three prominent peaks southwestward of Sycamore Bay. Approaching from southeastward they appear of nearly

equal height, the middle one flat on top. The northern prong is 2,075 feet high.

Pillar Mountain, a short ridge 1,206 feet high, rises steeply from the western shore about 1 mile southwestward of Kodiak.

Barometer Mountain is a peak 2,475 feet high lying 2 miles from the western shore of Chiniak Bay and 5 miles southwestward from Kodiak. It is a useful guide in clear weather for the northern approach, from which direction a notch shows on the western side of its summit.

Kodiak is a village and post office on the western shore of the bay inside Near Island. There is a good general store, fresh water is piped to the wharf, and coal in limited quantities can be obtained. There is communication by the mail steamers with Seward, Valdez, and points southwestward to Unalaska.

SOUTHERN ENTRANCE.

The entrance to the bay and harbor from southeastward is southward of Long and Woody Islands, and between the latter and Holiday Island. The principal dangers near the sailing line are:

Humpback Rock, lying 3 miles 143° true (SE by E ⅜ E mag.) from the south end of Long Island, is a pinnacle with two bare rocks about 5 feet high. There are numerous reefs between Humpback Rock and the southern shore.

Woody Island.—Foul ground extends ½ mile southward from Woody Island to Inner Humpback Rock, which is a pinnacle about 10 feet high. There is a kelp patch about 300 yards southwestward of the rock. A rocky patch with 6 fathoms over it lies ½ mile westward (true) from the southern end of Woody Island.

A sunken rock marked by kelp lies ¼ mile eastward (true) from the southern end of **Holiday Island** and ⅜ mile southward (true) of **Bird Islet**. A rock, bare at low water and marked by kelp, lies 200 yards from Bird Islet in the direction of the northern end of Woody Island. Foul ground and kelp extend 600 yards northeastward from the northern end of Holiday Island.

NORTHERN ENTRANCE.

The northern entrance to the harbor is not difficult in clear weather, but is dangerous at night or in thick weather. The soundings are irregular in the approach, and the lead can not be depended on as a guide to the entrance or to avoid danger. The principal dangers in the northern approach and entrance are:

Williams Reef is two rocks, 100 yards apart and bare at lowest tides, with deep water close-to. There are generally breaks on them, except near high water with a smooth sea. The reef lies 3¼ miles 26° true (N ⅛ E mag.) from the northeast end of Long Island, and 126° true (E by S mag.) from the summit of Spruce Island. The range of the cliffs at the southwest end of Long Island open from the high, grassy head at its northern end, bearing 221° true (S by W ½ W mag.), leads about ⅜ mile westward of the reef. Barometer Mountain in range with Kodiak village or the northwest side of Near Island, bearing 247° true (SW ¼ S mag.), also leads about ⅜ mile northwestward of it.

A small patch with 5 fathoms over it lies 1¾ miles 288° true (W ½ S mag.) from Williams Reef. The ranges given in the sailing directions for the northern entrance clear this patch.

Hutchinson Reef, partly bare at low water, is ¼ mile long, and its northern end lies ½ mile 122° true (E ¾ S mag.) from Hanin Rocks. There is a large kelp patch between the reef and rocks. A bell buoy is moored ½ mile northeastward of Hutchinson Reef to mark the end of the broken ground surrounding Spruce Cape.

On the western side of the channel, ⅜ and ¾ mile southward of Spruce Cape, are two bare reefs which extend 600 yards from shore. **Channel Rock**, the southern one, is a black rock about 10 feet high with extensive surrounding ledges. Kelp surrounds the reefs and extends ¼ mile southward of Channel Rock, and there is deep water close to the kelp.

A rock with 2 fathoms over it lies near the middle of the northern entrance, ⅞ mile 148° true (SE by E mag.) from Spruce Cape. The ranges given in the sailing directions for the northern entrance clear the rock. The rock is marked by a horizontally striped buoy. The clearer channel is westward of the rock.

Rocks, bare at low water, and kelp extend 1¼ miles northward from the eastern end of **Woody Island**, also nearly ⅜ mile northward and 300 yards westward from the northern end of the island.

CHANNEL WESTWARD OF NEAR ISLAND.

The channel on the northwest side of Near Island has a depth of about 26 feet and a width of only 50 to 60 yards in places. The dangers are marked by kelp, but it also sometimes grows in the channel. The entrance is between Cyane Rock and foul ground which extends nearly 200 yards from the bight in the western shore. **Cyane Rock** is 300 yards northward of Near Island and is bare at lowest tides; it is marked on its northerly side by a black buoy. The northern side of Near Island is foul, but its northwest side bordering the channel is bold. The western side of the passage is foul nearly to mid-channel until through the narrowest part. The passage is then clear to the wharf if the shores be given a berth of 50 yards.

The **wharf** is 150 feet long on its face and has 17 to 27 feet alongside. Vessels generally go to the end of the wharf port side to, heading northward, and it is preferable to approach it near high water slack. About 100 feet southward of the wharf is a shoal, on which is a rock crib and post that should be given a berth of 50 yards.

From the point southwestward of the wharf an extensive shoal extends ¼ mile southwestward. It is bare at low water 300 yards from shore, and there is 18 feet near its southern end abreast the narrow opening between Near Island and Uski Island, where it is marked by a red buoy. The range of the outer rock crib southward of the wharf and the western shore of the narrows ¼ mile 56° true (NNE ⅞ E mag.) from the crib leads close eastward of the southern half of the shoal.

A shoal extends 200 yards westward from Round Island, on the eastern side, 600 yards southward from the preceding shoal.

Anchorages.—The outer anchorage or roadstead is off **Shahafka Cove**, ⅞ mile northward of Near Island, in 13 to 14 fathoms, soft bottom. A good berth is with the high bluff south point of the cove

bearing 294° true (W mag.), distant 300 to 500 yards, and Barometer Mountain in range between Near Island and the water front of Kodiak. This is a good anchorage, but not convenient, owing to its distance from the landing, and it is exposed to considerable sea and swell in heavy northeasterly weather. A rocky patch with 5 fathoms over it lying ⅜ mile 107° true (E ⅝ N mag.) from the south point of the cove should be avoided when anchoring. The cove is shoal, and there are some shacks on it.

The inner anchorage is about ½ mile southwestward of the wharf and 250 to 300 yards from the western shore under Pillar Mountain, in 7 to 8 fathoms. This is a secure anchorage for well-found vessels, though there are heavy williwaws with northwest winds.

For tides see the Pacific coast tide tables, in which the tides are predicted for every day of the current year.

Currents.—In Chiniak Bay, including the passage westward of Near Island, the flood current sets northward and the ebb southward with considerable velocity in places among the islands. In the northern entrance the tidal currents have an estimated velocity of 2 to 3 knots at the strength of the large tides. They turn sharply around Spruce Cape across the reefs northward of it, and must be kept in mind.

DIRECTIONS, ST. PAUL HARBOR.

St. Paul Harbor and approaches are characterized by broken ground which generally has not been closely developed, and pinnacle rocks are a common feature. As a measure of safety, vessels should proceed with caution in the vicinity of shoal areas where abrupt changes in depth are indicated by the chart to depths less than about 10 or 12 fathoms.

Southern entrance.—Approaching from southward or eastward, **Ugak Island** will be made unless the weather is thick. This island can hardly be mistaken, as it is well detached from the land and possibly 1,200 feet high.

Cape Chiniak will be recognized by the islets and rocks extending northeastward from it, and may be rounded at a distance of 2 miles. Passing 2 miles or more off Cape Chiniak, steer for the south end of Long Island. The range of the south end of Long Island and the north peak of the Devils Prongs, bearing 313° true (WNW ¼ W mag.), leads over 1 mile outside the rocks off Cape Chiniak and ⅝ mile northward of Humpback Rock, and the distance from the cape to the rock is 5½ miles.

Pass ⅝ mile northward of Humpback Rock, steer 294° true (W mag.), and pass 1 mile southward of Long Island and ½ to ¾ mile southward of Inner Humpback Rock. On this course guard against the flood current, which sets strongly northward at times. Continue the course for 5 miles until 1 mile past Inner Humpback and the passage between Long and Woody Islands is closed.

Then steer 18° true (N ½ W mag.) for 2 miles and pass the western end of Woody Island at a distance of 200 to 250 yards. When Near Island opens northward of Holiday Island, steer 345° true (NW ½ N mag.) for the anchorage off Shahafka Cove.

To go to the wharf at Kodiak, round the northern end of Holiday Island, giving it a berth of over ⅜ mile, and enter as directed in a following paragraph.

Northern entrance.—From seaward, keep the summit of Spruce Island bearing anything southward of 294° true (W mag.) until the cliffs at the southwest end of Long Island are open westward of the high, grassy head at its northern end. Then steer for Barometer Mountain, course about 243° true (SW ½ S mag.), until on one of the ranges for the entrance.

From northward.—Directions from Marmot Strait to the entrance are given on page 27.

Or, for vessels approaching eastward of Marmot Island, from a position 3 miles off the southeast point of the island, steer 221° true (S by W ½ W mag.) for 26 miles, which should lead 2¼ miles westward of Williams Reef. Woody Island should be made ahead, its western end a little on the starboard bow, and the course and distance made good should lead to a position about ½ mile eastward of Hutchinson Reef bell buoy. Then enter on one of the ranges for the entrance.

Or, passing 1½ to 2 miles eastward of East Cape of Spruce Island, steer for the middle of Long Island, course about 180° true (SSE ⅛ E mag.), which will lead about ½ mile eastward of Hutchinson Reef bell buoy.

From Narrow Strait.—Pass ¾ mile northward of Hanin Rocks and steer 144° true (SE by E ⅜ E mag.) for 1¼ miles, heading for the northeastern end of Long Island, until the northwestern side of Near Island opens from the shore northeastward, and then enter on this range.

Entering on the ranges.—Either of the following ranges may be used:

Bring the water front of Kodiak just open from the western shore, bearing 243° true (SW ½ S mag.), and stand in on this range until the northern end of Woody Island is abeam. Then steer 229° true (SSW ¼ W mag.) for ½ mile, following the western shore at a distance of ¼ mile.

Or, bring the northwestern side of Near Island barely open from the shore northeastward, bearing 239° true (SW ⅞ S mag.), and stand in on this range until Spruce Cape is abeam. Then steer 229° true (SSW ¼ W mag.), pass 400 yards eastward of Channel Rock, and then follow the western shore at a distance of ¼ mile until ½ mile past the northern end of Woody Island.

Having followed the directions in either of the two paragraphs preceding, when Barometer Mountain is in line with the passage between Near Island and the water front of Kodiak, steer this range, course 247° true (SW ¼ S mag.), and anchor off Shahafka Cove (see "Anchorages" preceding).

To go to the wharf.—Steer the range of the preceding paragraph until up with the end of the small bluff ¼ mile northward of Near Island. Then bring the southernmost building (extreme left-hand one) near the wharf at Kodiak open 100 feet from Near Island (nearer that side than the western shore), and keep this range which leads in mid-channel westward of Cyane Rock where the channel is 75 yards wide. Keep the northwest side of Near Island aboard distant about 100 feet until through the narrowest part of the channel, and then steer for the wharf.

To go to the inner anchorage, when through the narrowest part of the channel steer 238° true (SW by S mag.), heading a little west-

ward of the islands southward, until abreast the first narrow opening between Near Island and the next islet (Uski) southward. Then haul westward to the anchorage under Pillar Mountain (see "Anchorages" preceding).

NARROW STRAIT TO WHALE PASSAGE.

Narrow Strait, between Spruce and Kodiak islands, is used by vessels from Kodiak bound to Shelikof Strait. It has a clear width of 1 mile at its eastern end, while at its western end the channel is 150 to 300 yards wide with a least depth of about 7 fathoms. With easterly gales a heavy swell sets into the strait, but this generally loses much of its force toward the western end.

There are two islands on the north side of the strait. The eastern one is very uneven and grassy on top; foul ground extends 300 yards southward from it. **Nelson Island**, the western one, is higher and wooded. A rock, bare at low water, lies 350 yards southward of Nelson Island, and three similar rocks lie ¼ to ½ mile westward of the island and about ⅜ mile from the northern shore.

Course Point, on the southern shore 1½ miles westward of Nelson Island, is prominent and is marked by a small, rocky, grass-covered islet 150 yards from shore.

Prokoda Island, in the middle near the western end of the strait, is 114 feet high and partly wooded. An islet lies 100 yards off its northeast end, and kelp extends 100 yards off the islet and the southeastern side of the island.

A rock, showing about 6 feet at low water, lies 250 yards southwestward from the western end of Prokoda Island. It is 40 yards southward of a line from the southern end of Prokoda Island to Uzinki Point. The channel southward of the rock has a depth of 7 fathoms and is 125 yards wide between it and a shelving spit with kelp which extends 125 yards from **Otmeloi Point**, on the southern shore.

The channel northward and westward of Prokoda Island is 300 yards wide and clear, but the turns are sharp and are sometimes difficult to make when the current is running.

Uzinki is a small native village at the head of the cove in Spruce Island northward of Prokoda Island.

The best **anchorage** in Narrow Strait is in the middle of the cove between Prokoda Island and Uzinki village, in 18 to 20 fathoms, somewhat exposed to an easterly swell. A small vessel and small craft can anchor at the head of the cove near Uzinki, slightly favoring the western side, in 5 to 10 fathoms.

Uzinki Point, the southwest end of Spruce Island, is wooded, and has several knolls about 100 feet high. There is kelp close to the point, and it should be given a berth of about 100 yards.

Entrance Point, on the south side at the western entrance of Narrow Strait, is grassy with some scattered trees, and a rock 10 feet high lies 100 yards off its eastern side. A kelp-marked shoal with 7 to 12 feet over it extends 250 yards northward from the point.

A good anchorage for a small vessel, exposed to northwest winds only, may be had in the cove between Otmeloi and Entrance Points in about 13 fathoms. The shore of the cove must be given a berth of over 100 yards, and a flat extends 300 yards from its head.

Low Island lies in the bight on the southern shore ¾ mile westward of Entrance Point. It is grass covered and about 40 feet high at its southern end. Near its northern end is a clump of trees. A shoal, with 20 feet at its end and some kelp, extends 350 yards northward of the island, and a bank with 7 to 8 fathoms extends northward to a spot with 17 feet over it lying 900 yards from the island.

Three Brothers is a kelp-marked reef 400 yards long and steep-to except on its eastern side. At its southwestern end are two rocks bare at half tide, and at its northeastern end is a rock covered at one-third flood. The southwestern end of the reef lies ½ mile 356° true (NNW ½ W mag.) from the northern end of Low Island, and is on the range of Uzinki Point and the tangent to the southern shore of Narrow Strait, bearing 120° true (E ½ S mag.). By keeping the strait well open vessels will pass clear southward of the reef.

Shakmanof Point is the prominent, heavily wooded point 1¼ miles westward of Low Island. Some rocks show at low water close to the point, and it should be given a berth of over 250 yards.

Kizhuyak Point, ¾ mile southwestward of Shakmanof Point, is higher than the latter, partly wooded, and terminates in white cliffs in places. A rock bare at half tide lies 400 yards northward from the point.

Between Kizhuyak Point and Kekur Point, a distance of 6 miles, there are two bays which have not been sounded.

Kizhuyak Bay is the head of Marmot Bay southward of Whale Island. Kekur and Peregrebni Points, lying 3½ miles southward of Whale Island, are at the entrance to the upper part of the bay, which trends 221° true (S by W ½ W mag.) for 2½ miles and then 181° true (SSE mag.) for 6 miles, with an average width of 1½ miles. In this part of the bay the depths are irregular, but the mid-channel is clear. The western shore from 1¼ to 4½ miles southward of Peregrebni Point is foul; a rock bare at low water lies 2¼ miles southward of the point and ⅜ mile from the western shore. Anchorage sheltered from northeasterly winds can be selected about 300 yards from the eastern shore and 3½ to 4½ miles southward from Kekur Point in 16 to 18 fathoms. A flat extends nearly ¼ mile from the mouth of the stream on the eastern shore 5¼ miles southward of Kekur Point and 1 mile northward from an islet. This islet lies ⅜ mile from the eastern shore and 2½ miles from the head of the bay; rocks bare at low water lie 300 yards westward of the islet. A flat extends ⅜ to ½ mile from the head of the bay where there is a large valley.

The **tidal currents** are weak except in the western entrance of Narrow Strait, where the estimated greatest velocity is about 2 knots.

For sailing directions see page 123.

WHALE PASSAGE,

between Whale and Kodiak Islands, is a part of the route used by vessels from Kodiak bound to Shelikof Strait. It is ½ to ¾ mile wide and generally clear, and the navigation is not difficult in the daytime when the current is not too strong. The depths are 9 to 30 fathoms, and the bottom is very uneven, especially in the eastern entrance.

Ilkognak Rock, awash at high water, lies in the middle of the eastern entrance. A sunken reef extends 250 yards southwestward, and a ledge with a least found depth of 6 fathoms extends ⅜ mile eastward from the rock. A detached rock with 4 fathoms over it lies 500 yards 44° true (N by E ¾ E mag.) from Ilkognak Rock, and 550 yards 151° true (SE ¾ E mag.) from a rock awash at high water near Whale Island. With a strong ebb current, heavy swirls and overfalls occur in the wake of this broken ground, and dangerous tide rips prevail at such times with northeasterly gales.

Shag Rocks, bare at half tide, lie a little over ⅜ mile southward of Ilkognak Rock.

A rock, with a least found depth of 16 feet, lies in the vicinity of the broken ground, with a charted depth of 8 fathoms, lying a little northward of the middle of Whale Passage and ⅞ mile westward of Ilkognak Rock. Gori Point, open a little southward of the south end of Koniuji Islet, leads in about the deepest water found by the survey, and southward of the rock.

Koniuji Islet, grass-covered and about 40 feet high, lies ¼ mile from the south side of Whale Passage and 2 miles westward of Ilkognak Rock. Kelp extends ¼ mile and broken ground ¾ mile westward from the islet. The channel is northward of Koniuji Islet, and it should be given a good berth, as the current sets toward it at times.

Temporary **anchorage** can be had in the bight on the north side of Whale Passage if stopped by too strong a flood current in the passage eastward. There is an eddy current in the bight, and care should be taken to get in far enough to ride to the eddy alone. A good berth is in about 8 fathoms, 300 yards from Whale Island, with Koniuji Islet bearing about 238° true (SW by S mag.).

A better anchorage can be had ¼ to ⅜ mile off the western side of Whale Island, in 8 to 10 fathoms. This is convenient to either Whale Passage or Afognak Strait and is well out of the current, but it is exposed to westerly winds.

The **tidal currents** in Whale Passage set westward on the flood and eastward on the ebb. The estimated velocity is 4 to 10 knots at strength, depending on the range of the tide. Slack water occurs about 1¼ hours before high and low waters at Kodiak. With a strong current swirls occur in the passage in the wake of all broken ground, and rips occur at the entrances when the current sets out against a strong wind. The worst place is at the eastern entrance, where these conditions are dangerous at times.

For sailing directions see page 124.

KUPREANOF STRAIT

extends from Whale Island to Shelikof Strait, between Raspberry and Kodiak Islands. Its width is 1¾ to 3 miles and the strait is generally clear, but there are shoals to be avoided off the southeast end of Raspberry Island, on the south side from Islet Point to the western end of Dry Spruce Island, and 4¼ miles westward of Dry Spruce Island and 1⅜ miles from the south shore.

The islands on both sides are grass-covered and mountainous, the north shore especially rising abruptly. The timber extends westward along the shores to Last Timber Point and Dry Spruce Island, where

it terminates except for scattered clumps. Anchorage may be had in places near the shore, but the only secure harbor is Dry Spruce Bay.

Between Deranof Island and the southeast end of Raspberry Island there are two wooded islands, the south end of the western one being **Nachalni Point.** **Thomas Rock,** awash at low water, lies ⅜ mile 226° true (SSW mag.) from Nachalni Point, and a patch with 6 fathoms over it lies ⅝ mile in the same direction from the point.

Chernof Point is a prominent, low, wooded point on the south shore, 2½ miles westward of Whale Island.

Islet Point, 2 miles westward of Chernof Point, is low and wooded, and has a high, grassy islet close-to. Broken ground with a depth of 4½ fathoms lies ⅝ mile 47° true (NNE mag.) from the islet.

Dry Spruce Island lies ¾ mile westward of Islet Point, with a wooded island between, the two islands and the shore eastward being joined by shoals dry at low water. It is 1⅜ miles long, 225 feet high, and wooded. Foul ground extends ⅜ mile northeastward from its eastern point, and broken ground with a depth of 5 fathoms lies over ⅜ mile northward from the same point. Two grassy islets and a pinnacle rock lie off the north side of the western point of Dry Spruce Island, and a ledge bare at half tide lies 650 yards 334° true (NW ½ W mag.) from the same point. Broken ground with a least found depth of 5 fathoms lies ⅝ mile northward from the western end of the island.

Bare Island, southward of the western end of Dry Spruce Island, is ⅞ mile long and partly wooded on its eastern half. There is a fox ranch on its northeastern side. A small grassy island lies ⅜ mile westward of Bare Island.

Dry Spruce Bay, the only secure harbor in Kupreanof Strait, is on the south side inside Bare and Dry Spruce Islands, and extends 2 miles eastward from the latter. The entrance between Dry Spruce and Bare Islands is over ¼ mile wide, and is clear with the exception of a rock bare at low water lying nearly 200 yards from the south side of Dry Spruce Island just inside its western end; a shoal extends 150 yards off the northern side of the eastern end of Bare Island. The entrance south of Bare Island and the small island westward of it is over ½ mile wide and clear. The bay is clear with the exception of a rock, bare at low water, in the middle, ¾ mile from its eastern end.

The best anchorage for large vessels is about ½ mile eastward of Bare Island and ⅜ mile off the cove in Dry Spruce Island, in 16 to 19 fathoms. A small vessel can anchor in the middle of the entrance to this cove in about 6 fathoms, taking care to keep clear of the flat, which extends 250 yards from its northeast side. With strong southwesterly winds some williwaws are felt from Kupreanof Mountain. Water may be obtained from a stream in a cove on the south side of the bay south (true) from the eastern end of Bare Island.

Approaching Dry Spruce Bay from eastward, give Dry Spruce Island a berth of ¾ mile, and steer for the western end of Bare Island on any bearing southward of 226° true (SSW mag.) until past the reef northwestward of the western end of Dry Spruce Island. Then haul eastward and pass midway between Dry Spruce and Bare Islands, course about 139° true (SE by E ¾ E mag.).

Approaching Dry Spruce Bay from westward, vessels may enter either between Bare and Dry Spruce Islands, or south of Bare Island and the small island westward of it.

A rock with 16 feet over it lies in Kupreanof Strait 4¼ miles westward of Dry Spruce Island, 1⅜ miles from the south shore, and 2¼ miles 97° true (ENE ½ E mag.) from the northern extremity of Outlet Cape. It is at the northern end of a bank about ¼ mile in diameter with depths of 7 to 20 fathoms. The range of Chernof Point and the southern side of Whale Island leads 200 yards northward of the rock.

Onion Bay makes into Raspberry Island about 2 miles, and from its head a low divide extends through to Shelikof Strait. The entrance is narrow, and just inside it the bay is blocked by shoals partly bare at low water, between which are narrow channels suitable only for small craft. Above these shoals the bay has depths of 15 to 21 fathoms. The tidal currents have an estimated velocity of 3 to 5 knots in the entrance. Temporary anchorage can be had ⅜ to ½ mile off the entrance, in 10 to 15 fathoms.

Outlet Cape is the western end of the peninsula included between Kupreanof Strait and Viekoda Bay. The cape has a steep slope to a peak 1,620 feet high, eastward of which is a low divide extending through. A cluster of bare rocks lies 350 yards off the northwest end of the cape. **Kupreanof Mountain,** 7¼ miles eastward of Outlet Cape, has a surface of broken, gray rock; it is 2,400 feet high.

Malina Point, 2 miles eastward of Raspberry Cape, is projecting and prominent. It has a grass-covered knoll at its end, with a low neck behind it, and then a steep slope to 1,500 feet.

Raspberry Cape, the southwestern end of Raspberry Island, is steep and high, and has areas of bare rock for one-third its height. There are some bare rocks in the water close to its foot.

Tides.—At Onion Bay high and low water occur about 26 minutes later than at Kodiak, and the mean rise and fall of the tides is 11.8 feet. To find the approximate height of the tide, multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.71. The tides meet in the strait a little westward of Dry Spruce Island. The tidal currents in Kupreanof Strait have an estimated velocity of 2 to 3 knots at the strength of the large tides.

DIRECTIONS, KODIAK TO SHELIKOF STRAIT.

Narrow Strait.—Coming from Kodiak, pass 400 yards eastward of Channel Rock and steer 49° true (NNE ¼ E mag.) for 2 miles, passing westward of the horizontally striped buoy marking the 12-foot rock and over ¼ mile eastward of Hutchinson Reef bell buoy. When Miller Point opens northward of Hanin Rocks, bearing 280° true (WSW ¾ W mag.), change course to 300° true (W ½ N mag.), with Uzinki Point just open from the southern shore of Narrow Strait ahead, and pass ¾ mile northward of Hanin Rocks. Steer this range for 4½ miles past Hanin Rocks until Nelson Island is ½ mile on the starboard beam. Then steer 304° true (W ⅞ N mag.), pass about ¼ mile northward of Course Point, and continue the course about ¾ mile past the point.

When Shakmanof Point shows in the middle of the passage southward of Prokoda Island, bearing 290° true (W ⅜ S mag.), steer this course, pass 75 to 100 yards southward of the rock westward of the island, and give Otmeloi Point on the south shore abreast the rock a berth of 150 yards. Continue the course until Uzinki Point is 125 to not over 150 yards on the starboard beam.

Then steer 297° true (W ¼ N mag.) for 2¼ miles with the tangent to the southern shore of Narrow Strait astern, and pass 650 yards northward of Low Island, 300 yards southward of Three Brothers, and ¼ mile northward of Shakmanof Point.

Whale Passage.—From a position ¼ mile northward of Shakmanof Point steer 263° true (SW by W ¼ W mag.) for 6¾ miles, passing over ⅜ mile northwestward of Kizhuyak Point. The southern end of Whale Island will show as a small wooded head, and there is a rock awash at high water close-to. Keep the southern end of the island aboard distant about 350 yards in entering Whale Passage, and pass about 300 yards southward of the rock awash at high water and ¼ mile northward of Ilkognak Rock. Strict attention to the steering is important on account of heavy swirls.

Then steer 298° true (W ⅜ N mag.) with Gori Point in range with or open a little southward of the south end of Koniuji Islet; or Ilkognak Rock astern and Koniuji Islet ahead will also lead in about the best water southward of the 16-foot rock. When about ¾ mile from the islet steer 317° true (WNW mag.) for the end of Whale Island to a position ¼ mile northward of Koniuji Islet.

Kupreanof Strait.—From a position ¼ mile northward of Koniuji Islet steer 292° true (W ⅛ S mag.) for 7¾ miles, passing ⅜ mile northward of Chernof Point, to a position ⅜ to ½ mile southward of Gori Point. Then steer 286° true (W ¾ S mag.) with the summit of Whale Island astern, passing ⅞ mile northward of Outlet Cape and ½ mile southward of Malina Point, the distance from Gori Point to Malina Point being 10¼ miles.

If bound down Shelikof Strait, from a position ½ mile southward of Malina Point make good a 244° true (SW ⅜ S mag.) course for 18 miles, which leads 1½ miles westward of Cape Uganik and to a position 2 miles westward of Cape Ugat. Then a 230° true (SSW ⅜ W mag.) course made good for 28 miles will lead nearly 2½ miles westward of Cape Uyak and to a position 2 miles westward of Cape Karluk

SHELIKOF STRAIT.

The triangulation has been extended southward through the strait. to Cape Karluk and Cape Kubugakli. Only the outlying islands and rocks are located from the northwest end of Shuyak Island to Black Cape, but from the latter point to Cape Karluk most of the points are determined by triangulation. From Shaw Island to Takli Island most of the principal points and outlying rocks are located.

The hydrography of the main part of the strait has been done from Barren Islands southward to Raspberry Island. In this part of the strait great depth is not generally found near the land, and depths suitable for temporary anchorage will be found near the shore in most places. In thick weather or when uncertain of the position the depth should not be shoaled to less than 50 fathoms.

Currents.—Current observations were made for short periods at the anchorages used by the surveying vessel near the shore. The currents are principally tidal, but the relation of the current to the rise and fall of the tide is not in all cases clear. On the western side of the strait a current of ½ and ¾ knot is recorded, setting along shore in either direction. It is believed that along the western shore the southerly current predominates.

Between Cape Douglas and Shaw Island the current is stronger, a 2-knot current being recorded, setting along shore to and from Kamishak Bay. The current seems to decrease in velocity with increase of distance from shore. Apparently there is less current along the west coast of Afognak Island than on the opposite side of the strait.

Strong tidal currents are encountered off the northwest side of Shuyak Island, and heavy tide rips variable in position are frequently seen along the western side of Dark Island and Latax Rocks. The flood sets into Shelikof Strait and the ebb the opposite way. The direction of the set is dependent upon the adjacent land, and a knowledge of its configuration will enable one to estimate closely the direction of the set. The greatest velocity recorded on the southwest side of Dark Island is 1.3 knots on the flood, but this probably is not the maximum velocity. On the day of the observations slack water occurred near the time of low water at Kodiak.

Weather.—During the summer of 1908 gales and rainy conditions were frequent. June was the best month and July perhaps the worst. Northeast winds invariably bring rain and thick weather, and it is from this direction that most of the heavy weather comes. During the greater part of the season the wind when strong from this quarter rarely varied much in direction while its strength lasted, and it never backed. In the latter part of the season a northeast gale almost invariably backed through northwest to west or southwest, blowing with great force.

Southeast winds generally bring clouds, but may be accompanied by either rain or fair weather.

Southwest and west winds are invariably accompanied by fine clear weather, but they often blow with great force. The southwest gale is perhaps the most to be dreaded in Shelikof Strait, as it raises a short, heavy sea that is trying to a small vessel.

Southerly winds generally bring haze, which is sometimes so thick as to resemble fog.

Northwest winds bring fair weather and a clear atmosphere.

Gales in this region last without intermission anywhere from a day to two or three days.

Northeast winds are generally accompanied by a low barometer and southwest winds by a high barometer, but the rule is not invariable. The barometer is of little or no value in foretelling the weather, as it accompanies rather than precedes corresponding conditions. The slope of the barometric curve is apt to change suddenly, the weather changing with equal suddenness. A sure sign of rainy weather and wind from northeast is the gathering of clouds on the northeast side of the mountains.

Little fog was encountered during the season, but blinding snowstorms were frequent early in spring.

WEST COAST OF SHUYAK AND AFOGNAK ISLANDS.

The general trend of the western coast of Shuyak and Afognak Islands is 218° true (S by W ¼ W mag.), and the distance from the northernmost of the Latax Rocks to Raspberry Cape is 48 miles. From Raspberry Cape the eastern coast of Shelikof Strait trends 230° true (SSW ⅜ W mag.) for 45½ miles to Cape Karluk.

Party Cape is the northwest end of Shuyak Island. A reef bare at low water lies about midway between the cape and **Dark Island.**

The latter lies 1¼ miles northward from the cape, and is about ¾ mile in diameter, about 200 feet high, and grass-covered. There are several large black rocks off the southwest end of Dark Island.

Latax Rocks are a chain of three rocky islets, about 60, 50, and 30 feet high, respectively, lying 1¼ to 3 miles northward of Dark Island. Between the two outer ones is a reef bare at low water, and a rock bare at low water lies about ⅜ mile northward of the outer rock. Vessels should not attempt to pass between Party Cape and the outer rock, 5¼ miles northward, in the absence of a survey.

A depth of 7 fathoms, with a probability of less, was found 1½ miles westward of the southernmost Latax Rock.

The western side of Shuyak Island is irregular and fringed by a chain of islets and rocks 1 to 2 miles from shore. Between them and the island there are many rocks and kelp patches. Some of the outer ones are located, and these only are mentioned. They lie nearly on a line from the rocks westward of Party Cape to Black Cape, bearing 214° true (S ⅞ W mag.).

A rock a few feet high lies ⅞ mile westward of Party Cape. **Shag Islet**, rocky and about 50 feet high, lies 1 mile southward of the preceding rock and about ⅝ mile from a point on Shuyak.

Gull Island, the highest and most prominent of the off-lying islets, is about 150 feet high, and has a rounded, grass-covered summit. It lies 2¾ miles southwestward from Party Cape. Some rocks, covered or awash at high water, lie off the south side of Gull Island, and kelp shows between it and Shuyak.

Rocks show at low water some distance off the southwest point of Shuyak Island.

A rock with 6 feet over it is reported near the middle of the bay on the west side of Shuyak Island, eastward of Eagle Cape.

Shuyak Strait has not been examined. It is reported to have strong tidal currents.

From Shuyak Strait to Black Cape, the coast of **Afognak Island** is irregular, rocky, and wooded. Many islets lie offshore, especially near Black Cape. Three prominent islets lie nearly on line from the cape to the islets off the western side of Shuyak. The northern one, lying 6 miles from Black Cape, is a large black rock. The second one is about 40 feet high and lies 1¼ miles southward of the preceding rock. The third, lying 2½ miles from Black Cape, is about 40 feet high and broken into several parts, and there are many rocks and islets between it and the shore.

Black Cape is low and grassy at the end, and rises gradually in a narrow heavily wooded ridge to a prominent bald knob, 1,155 feet high. Bare and sunken rocks extend a short distance off the cape, and a reef, mostly showing above water, lies on its south side.

The bay between Black Cape and Ban Island has reefs, which do not extend westward of the island.

Ban Island is mountainous, its highest peak being found near its south shore. There is kelp close to its west end.

Paramanof Bay, between Ban Island and Cape Paramanof, is not surveyed. It is recommended to favor Ban Island when entering. The *Explorer* anchored on the south side, 3 miles eastward of Cape Paramanof and about ½ mile off a rocky shore, in 22 fathoms, soft bottom. There is a short sand beach just eastward of the anchorage, and a rocky islet close to shore a short distance westward. The

anchorage is exposed to westerly and northerly winds. There is said to be good anchorage farther in, but no definite information is available.

Cape Paramanof is the northwest end of the peninsula included between Paramanof and Malina Bays. It is a low tongue of land projecting ½ mile northward from the mountains. A reef lies on the north side of the cape inside Paramanof Bay, and a part of it, about ½ mile from shore, is bare at low water.

The peninsula between Paramanof and Malina Bays is marked by two mountain ridges trending eastward, with a small stream in the valley between them. The land is grass covered, with bare rocks in places, and there is no timber. The northern ridge rises in steep, grassy slopes to an elevation of 1,842 feet, with a saddle behind it and then extends eastward with about the same height. **Tanaak Cape** is the northern point at the entrance of Malina Bay.

Malina Bay is described below.

Steep Cape is a cliff 1,600 feet high, with a deep break (saddle) behind it, and then a gradual rise to higher land. From offshore the top of the cliff shows irregular, but from northward or southward the summit is sharp. Lying 1 mile northward of Steep Cape is another cliff 1,060 feet high, which is on the south side at the entrance to Malina Bay.

Raspberry Strait, between Afognak and Raspberry Islands, is not surveyed. Its southeast end is bare at low water.

Raspberry Island is mountainous and grass-covered on its western side, the principal points being three high cliffs, between which are two deep valleys trending eastward. The southern valley, about the middle of the island, is especially low, and extends through to Onion Bay.

MALINA BAY

lies between the mountainous peninsulas terminating westward in Tanaak and Steep Capes. It is about 10 miles long and is a secure harbor. Water can be obtained from numerous small streams. There is some timber near the head of the bay and in some of the valleys. Steep Cape and the high cliff at the south point at the entrance, and the rounded grass-covered mountains on the northern side of the bay, mark the entrance.

The bay is 2½ to 3 miles wide for nearly 4 miles and then contracts rapidly to a neck about 1½ miles long with a least width of ⅜ mile. From the south side of the neck an arm extends 1½ miles southeastward. Above the neck is a basin 2 miles long with a greatest width of 1¼ miles. From the eastern end of the basin an arm extends 2 miles eastward, with a width of about ¼ mile; it is filled by a flat nearly to its mouth.

The outer part of the bay is clear, with the exception of a rock bare at low water lying ¼ mile from shore in the bight on the south side nearly 4 miles inside the entrance. Rocks awash at high water extend 300 yards off the south side at the entrance to the neck, and lie ½ mile westward of the island in the entrance of the southeast arm. The depths are suitable for anchorage ¼ to ⅜ mile from shore nearly anywhere in the outer bay. An anchorage, exposed only to westerly winds, can be had on the north side of its eastern end, about ¼ mile westward of an islet, and the same distance from the shore northwestward, in 15 fathoms, sticky bottom.

In the **neck** off the entrance of the southeast arm is an island, ⅜ mile long and 115 feet high, with a clump of trees near its middle. There is no safe passage between it and the shore southeastward. An islet 30 feet high lies on the south side of the neck ⅜ mile eastward of the island, and foul ground extends 225 yards from the south shore just eastward of the islet. A rock 15 feet high, with a small one close westward, lies 400 yards northeastward of the islet, the best channel being between them. A rock bare at low water lies 400 yards eastward of the rock 15 feet high and over 300 yards from the northern shore.

To go through the neck, pass 200 yards northward of the island, steer 121° true (E ⅝ S mag.), and pass 100 yards southward of the rock 15 feet high lying in the middle of the neck.

The **basin** has depths of 30 to 47 fathoms in its western half and shoals gradually eastward, affording secure anchorage. A rock covered at high water lies 400 yards westward from the north point at the entrance to the narrow arm extending eastward, and a shoal extends 600 yards southwestward from a point on the north shore ⅜ mile northward of the rock. The best anchorage is about ⅜ mile off the bight at the northern end of the basin, with the entrance (neck) just closed, in 15 to 18 fathoms, sticky bottom.

The **southeast arm** is a secure anchorage with a clear width of nearly ¼ mile. The northwest point of the island in the entrance should be given a berth of over 100 yards, and a rock bare at low water lies 100 yards from the shore southwestward of the same point.

To enter the southeast arm, steer 163° true (SE ⅜ S mag.), pass 150 yards southwestward of the northwest point of the island, and follow the southwest shore of the arm at a distance of about 250 yards. Anchor in the broad part about ⅝ mile from the head, in about 10 fathoms, sticky bottom. A flat extends nearly ⅜ mile from the head.

Tides.—High and low water occur about 20 minutes later than at Kodiak, and the mean rise and fall of the tides is 12 feet. To find the height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.74.

VIEKODA BAY

is on the eastern side of Shelikof Strait between Outlet Cape and Uganik Island. It extends into Kodiak Island in a 131° true (ESE ½ E mag.) direction, and has a length of 13½ miles from Outlet Cape and 17 miles from Cape Uganik. The lower part of the bay is 3 miles wide. From its southern side, 8 miles below the head, Uganik Passage extends southeastward. Above Uganik Passage the bay is 2 miles wide and narrows to ½ mile at its head.

Foul ground exists near the shore in places, but except where mentioned below danger will be avoided by giving the shore a berth of ½ mile.

The head of the bay is shoal for 1 mile to two islets. About ½ mile below the islets there are two islands near the southern shore. Good anchorage may be had ½ to 1 mile below the islands and about 2 miles from the head of the bay, in 12 to 17 fathoms.

Off the entrance, 2¾ to 3¼ miles from Outlet Cape, is a bank on which the least depth found is 6¾ fathoms at its northeast end, lying 267° true (SW by W ½ W mag.) from the north end of Outlet Cape and 166° true (SE ⅝ S mag.) from Raspberry Cape.

A narrow point, its end detached, extends ⅜ mile from Uganik Island 1 mile eastward from its northern end. Broken ground, with depths of 4 and 5 fathoms, extends ⅝ mile 10° true (N by W ¼ W mag.) from the point. There is a fair anchorage in southerly weather in the bight on the east side of the point, ¼ to ⅜ mile from shore, in 10 to 15 fathoms.

A rock, with 4½ fathoms on it and which should be avoided, lies ⅝ mile from Uganik Island and 2½ miles westward of the point dividing Viekoda Bay and Uganik Passage.

The latter point has an islet near it, and a rock bare at low water lies ¾ mile above the islet and ⅜ mile from the south shore of Viekoda Bay. Depths of 3 to 5 fathoms extend ¼ mile northward of the rock.

UGANIK PASSAGE

borders the northeast and south sides of Uganik Island and connects Viekoda and Uganik Bays. The depths in the passage are too great for anchorage except in Terror Bay.

The part of Uganik Passage on the northeast side of Uganik Island is clear in mid-channel except 5 miles from Viekoda Bay and 1 mile from the southeastern end of Uganik Island. At this point a flat makes two-thirds the distance across the passage from the mouth of a stream in a large valley on the northeastern shore, and leaves a clear channel 350 yards wide close to a point of Uganik Island. There is an islet close to Uganik Island in the bight southeastward of this point.

Terror Bay extends 4 miles 190° true (S by E ¼ E mag.) from the southeast end of Uganik Passage, with a width of ⅝ to ¾ mile. It then narrows to ⅜ mile, trends 154° true (SE ½ E mag.) for nearly 2 miles, and is filled by a flat. The main bay is clear with the exception of three rocks which lie 300 yards from the western shore; the first two, lying ¾ and 1¼ miles inside the entrance, have 3 feet over them; the upper one, lying 1¾ miles inside the entrance, is bare at low water. There is secure anchorage for vessels of any size 3 to 4 miles above the entrance and about 2½ miles from the head of the bay, in 7 to 15 fathoms.

The part of Uganik Passage south of Uganik Island is 9 miles long from the southeastern end of Uganik Island to East Point, where it joins Uganik Bay.

A rock bare at low water lies ¼ mile from the south side of Uganik Island ⅝ mile from its southeastern end.

A high **peninsula** extends southeastward from Uganik Island 2 miles from its southeastern end and narrows the passage to ¼ mile. From the point on the south shore southeastward of the peninsula a ledge bare at low water makes nearly halfway across the passage where narrowest, and the southeast end of the peninsula must be kept aboard distant 100 to 150 yards until past the narrowest place.

Westward of the peninsula is an island in the middle of the passage, in the vicinity and westward of which are several rocks, sunken and bare at various stages of the tide. Vessels from eastward may pass northward of the foul ground by following the southwest shore of the peninsula at a distance of about 200 yards until the island is abaft the port beam, and then steer 300° true (W ½ N mag.) for

the southernmost point on Uganik Island which shows ahead with the summit of the peninsula a little on the port quarter. When the bare rock ⅜ mile westward of the island is abaft the port beam the dangers will be passed. These are:

A rock bare at low water lies 300 yards northeastward of the island.

A rock bare at low water lies 250 yards northward of the bare rock ⅜ mile westward of the island.

Foul ground and rocks bare at low water extend ¼ mile from Uganik Island ⅜ to ⅞ mile westward of the peninsula.

The channel southward of the island is narrower than that northward. To go through this channel from eastward, bring the south end of the peninsula barely open from the point eastward astern, and steer for the prominent point on the south shore ¾ mile westward of the island, course 281° true (WSW ⅞ W mag.). Keep close on this line, passing midway between the island and an islet near the south shore ¼ mile westward of the island. When the islet is passed, haul northward and give the point a berth of over 200 yards. The principal dangers are:

A rock bare at low water lies 200 yards southwestward of the island.

A rock with 8 feet over it lies ⅜ mile westward of the island and ¼ mile northwestward of the islet.

The islet should be given a berth of over 100 yards, and the south shore for ¾ mile eastward of the islet should be given a berth of 250 yards.

Westward of these dangers Uganik Passage is broad and free from outlying dangers. In the large bight of Uganik Island 5 miles eastward of East Point shoals extend ½ mile from its northwest shore for a distance of 1 mile from its head. From this bight a broad, low divide extends across the island.

Rocks bare at low water extend ½ mile from the south shore of the passage 1¾ miles eastward of East Point, and ½ mile farther eastward rocks make out 600 yards on the northwest side of a point on the south shore.

UGANIK BAY

is on the eastern side of Shelikof Strait, between Uganik Island and the mountainous peninsula terminating westward in Cape Ugat. Only the entrance from Noisy Islands to East Point is sounded. Anchorage with shelter from southerly and westerly winds can be had in the bight 2 miles southeastward of Broken Point, and there is secure anchorage in East Arm. Heavy williwaws occur during southwest gales, which are worst toward the head of the bay where the mountains are highest. The shores rise abruptly with cliffs in places, and are generally covered with grass and bushes.

Cape Uganik, the northwest end of Uganik Island, is low for about ¼ mile back, and then rises quickly to elevations of 1,200 to 1,500 feet. A valley extends across the island about 1½ miles eastward of the cape, and the gap can be seen from southward. For a distance of 1½ miles southward from the cape shoals extend about ¼ mile from shore in places.

Noisy Islands lie ½ to ⅝ mile from Uganik Island and 2½ miles southward of Cape Uganik. The group is 1 mile long and is two principal islands—the northwest one 205 feet high, the southeast one low and flat. Reefs extend about ¼ mile northward and northwest-

ward from the northwest island, and possibly as much southeastward from the southeast island. The passage between them and Uganik Island has a depth of about 8 fathoms.

Cape Ugat is on the eastern shore of Shelikof Strait 12 miles southwestward from Cape Uganik. It is a high ridge sloping to a low rocky shelf at the point of the cape. A short distance off the cape is a rocky, grass-covered islet, which can be seen about 15 miles on a clear day and is a good mark. **Little River** is on the south side of Cape Ugat.

Miners Point, 4¼ miles northeastward from Cape Ugat, terminates in two island-like knobs, the inner one 430 feet high and conical, the outer one lower and flatter.

Broken Point, 3¼ miles eastward from Miners Point, is low and flat for ⅜ mile back, its end being detached, and then rises to high land. A depth of 3½ fathoms, with deep water close-to, was found 400 yards northward of the point. The entrance of Uganik Bay is 3 miles wide between this point and Noisy Islands, and inside the point the bay widens to about 5 miles until up with East Point.

A stream empties in the bight 1¾ miles southward of Broken Point. There is good anchorage sheltered from southerly and westerly winds about ¾ mile southeastward of the mouth of the stream and ⅜ to ½ mile from shore, in 8 to 15 fathoms.

East Point, 5 miles eastward of Broken Point, is the northwestern extremity of the high peninsula separating Uganik Bay and Passage. There is a flat rock with bluff sides close to the point, and from the latter there is a long, gentle slope to high land.

At East Point Uganik Bay is 2½ miles wide, from which it extends 12½ miles 180° true (SSE mag.), narrowing gradually, to the head of South Arm. Little sounding has been done, but the bay is clear so far as known.

Northeast Arm, not surveyed, extends eastward from Uganik Bay 2½ to 4 miles southward of East Point. **Rock Point,** the south point at the entrance, is marked by several bare rocks which extend off 250 yards.

Village Islands are numerous islands and rocks extending ¼ to ½ mile from the western shore 2 to 4 miles southward of East Point. In the cove between the south end of the islands and Village Peninsula anchorage is reported for small vessels. There is a native village at the head of the cove.

East Arm extends eastward from Uganik Bay 7 miles southward from East Point. It is 1 mile wide at the entrance and over 3 miles long, but a flat extends 1½ miles from its head or ½ mile below the island in the bight on the south side of the arm. The depths range from 15 fathoms at the entrance to 6 fathoms near the edge of the flat. The arm is clear so far as known and is a secure anchorage for vessels of any size. It is subject to heavy williwaws during southwest gales, but these are not dangerous to well-found vessels. The north point at the entrance is a low spit, on which is a disused cannery.

South Arm extends 5½ miles southward from the south point of East Arm. No sounding has been done.

DIRECTIONS, UGANIK BAY.

From northward, round Cape Uganik at a distance of 1 mile and steer 222° true (S by W ⅝ W mag.) for 3¼ miles to a position 1 mile westward of Noisy Islands. Then steer 164° true (SE ½ S mag.), passing about ⅞ mile off the western shore from West Point to Village Islands, and ½ mile eastward of the islands. This course made good for 10 miles should lead to a mid-channel position between the southernmost of the Village Islands and Rock Point. Then steer 192° true (S by E mag.) for 2½ miles, following the eastern shore at a distance of about ½ mile, to the entrance of East Arm.

From southward, give Cape Ugat and Miners Point a berth of about 1½ miles and Broken Point a berth of about ¾ mile. Then steer 154° true (SE ⅜ E mag.) for 3½ miles to a position about ⅞ mile off West Point. Then steer 164° true (SE ½ S mag.) for 4 miles to a mid-channel position between the southernmost of the Village Islands and Rock Point as in the preceding paragraph.

UYAK BAY

is on the eastern side of Shelikof Strait southward of the mountainous peninsula terminating westward in Cape Ugat. Uyak Anchorage, a secure harbor convenient to Shelikof Strait, is on the southern side of the bay, 16 miles southward of Cape Ugat and 18 miles northward of Cape Karluk. Some of the points in the approach to the bay are determined by triangulation, and Uyak Anchorage and Uyak Bay above Harvester Island are surveyed. The principal dangers in the surveyed areas are mentioned in the description following.

The approach between Cape Kuliuk and Rocky Point is about 11 miles wide, eastward of which the bay converges rapidly to Harvester Island. It extends 25 miles in a southeasterly direction above Harvester Island, and is 3 to 4 miles wide from the latter to Amook Island. The shores of the bay rise in steep slopes to elevations of 2,000 to over 4,000 feet, and there are numerous mountain streams.

Cape Kuliuk, about 5 miles southward from Cape Ugat, is a cliff at the end of a ridge about 2,000 feet high.

From Cape Uyak high cliffs extend about 5 miles northeastward to **Rocky Point.** Between Rocky Point and Bear Island the coast is low bluffs, and a wide valley extends back several miles.

Bear Island, about 5½ miles east-northeastward from Rocky Point, is nearly ⅜ mile in diameter, 249 feet high, and grass-covered. It lies ¼ mile from shore, with which it is connected by a bowlder spit, bare at half tide.

Harvester Island, ¾ mile eastward of Bear Island, is over 1 mile long, 844 feet high, steep-sided, and grass covered. The 20-fathom curve is about ¼ mile off the northern and eastern sides of the island.

Uyak Anchorage is the best harbor on the eastern side of Shelikof Strait southward of Uganik Bay, and is easily entered. It lies between Harvester Island and the shore, the passage having a width of ¼ to ⅜ mile. The depths range from about 7 fathoms between Harvester and Bear Islands to 20 fathoms ¼ mile northwestward of the cannery. The best anchorage is about ½ mile northwest of the cannery, in 12 to 14 fathoms. There is also good anchorage, except with heavy northeasterly or easterly winds, in the bight ¼ to ⅜ mile southeastward of the cannery and ¼ mile from shore, in 12 to 14 fathoms.

The better and safer entrance is around the south end of Harvester Island. **Cormorant Rock**, bare at half tide, lies over ⅝ mile southeastward of Harvester Island and 300 yards from shore. A spit, bare at low water and steep-to, extends 425 yards 218° true (S by W ⅜ W mag.) from the south end of Harvester Island. This spit, has extended 45 yards in the direction of its axis between the years 1908 and 1915.

The northwest entrance is ⅜ mile wide between two reefs, partly bare at half tide and marked by kelp, one extending 400 yards westward from the northwest end of Harvester Island, and the other lying 250 to 550 yards eastward from Bear Island. With care this entrance is not difficult in the daytime, especially at low water when the principal dangers show above water.

Uyak is a post office and cannery on the southwest side of Uyak Anchorage southwestward from the south end of Harvester Island. There is a depth of 20 feet at the end of the north wharf and 9 feet at the south wharf. Water can be obtained through pipe and hose. There are some buildings and the remains of a wharf in the bight ⅜ mile southward of the cannery.

The large arm on the eastern side of Uyak Bay opposite Harvester Island is not surveyed.

Zachar Bay is on the eastern side, 6 miles 124° true (E by S mag.) from Harvester Island and 2½ miles northward from Amook Island. It is 6 miles long 124° true (E by S mag.) and ¾ to 1 mile wide. No sounding has been done, but the north side is apparently clear. The south point at the entrance is surrounded by sunken reefs, and a reef bare at half tide lies ⅜ mile northward from the point. A flat extends nearly 2 miles from the head of the bay.

Larsen Bay is on the western side, 6 miles southward of Harvester Island and 262° true (SW by W ¼ W mag.) from the north end of Amook Island. It is 4 miles long 259° true (SW by W mag.), about ½ mile wide, and has depths of 30 to 40 fathoms on its northwest side and less on the opposite side. From its head low land extends to Karluk River, a distance of about 2 miles. A cannery is maintained by the Alaska Packers' Association in the bight just southward of the inner south entrance point.

The entrance to Larsen Bay is through a crooked channel ½ mile long and 200 yards wide, between flats partly bare at low water, one extending 300 yards southward from the north point at the entrance and the other filling the bight on the south side opposite. A rock bare at low water lies in the entrance of the channel 200 yards northwestward from a black rock about 20 feet high, which lies 100 yards off a point on the south shore. The better channel is between the black rock and the rock awash, and has a depth of about 27 feet. The tidal currents in the entrance have an estimated velocity of 2 to 4 knots at strength.

Strangers should enter Larsen Bay at low water, or buoy the rock at the entrance and the flat on the north side. With care small vessels can enter by the following directions: Pass 75 to not over 100 yards northward of the black rock near the south shore, and steer 260° true (SW by W mag.) for the mound on the southern side until the north point at the entrance is abeam and the disused cannery is open about one-half point westward of it. Then haul northwestward and pass about 200 yards northward of the mound.

Anchorage can be had in mid-channel southward of the disused cannery on the north side just inside the entrance, in 5 to 8 fathoms. Near the south shore of Larsen Bay 1 mile southward of the disused cannery is a small island. There is good anchorage 300 to 400 yards northward or northwestward of the island, in 6 to 10 fathoms, but care must be taken to avoid the flat which makes out ¼ mile in the bight northeastward of the island. A flat extends about ¼ mile from the head of the bay; anchorage can be had below the flat in 10 to 12 fathoms.

Amook Island, 7½ miles long and 1,686 feet high, divides Uyak Bay into two passages, the north end of the island lying 6½ miles southeastward of Harvester Island. Reefs extend ¼ mile northward from the north end of Amook Island.

The passage west of Amook Island is the principal one. It is 1 to 1¾ miles wide and generally clear. In the bight of Amook Island 2½ miles from its north end there is anchorage for a small vessel, in about 10 fathoms, with shelter from easterly and southerly winds. The bottom is uneven and there is a possibility of dangers. The entrance is between the south point of the bight and a bare rock lying ⅝ mile northward from the point and ½ mile from Amook Island. Between this rock and the island is a reef, partly bare at low water, which extends ½ mile southeastward from an islet.

A rock, bare at low water and which may be passed on either side, lies ¼ mile from Amook Island and ⅜ mile 253° true (SW ½ W mag.) from its south end.

The passage east of Amook Island is obstructed at points 2½ miles from the north end of the island and 3¼ miles from the south end, and should be used only by small vessels with local knowledge. For a distance of 2½ miles the north end of the passage is clear, with depths of 14 to 20 fathoms, and anchorage can be had here. At the southeast end of this anchorage is a shallow lagoon at the mouth of a deep valley. Small vessels can anchor 300 yards off the mouth of the lagoon in 5 to 6 fathoms.

At ¼ mile westward of the lagoon the passage narrows to 300 yards, and from the east point of the narrows a kelp-marked reef extends westward and northwestward over halfway across, leaving a narrow channel between it and the west shore. Near the northwest end of the reef is a bare rock. There is a good anchorage around the point on the west side at the south end of the narrows, in 5 to 8 fathoms.

Thence for a distance of 2 miles the passage is clear to the second narrows. At this point a spit partly bare at low water extends halfway across from a low grassy point on the west side, and leaves a channel 125 yards wide between the southeast end of the spit and an island. The channel is westward of this island and the next one ⅜ mile southward, and the western shore should be favored until over ¼ mile southward of the southern island. Southward of this point the passage is clear. Some prospecting has been done on the east side of the passage 2 miles from its south end.

Lying ¾ to 2½ miles southward of Amook Island is a chain of islands with foul ground between them and about 300 yards off the northwest end of the northern one called **Alf Island.** There is deep water between the islands and the foul ground abreast them making out from the western shore, but the safer channel is eastward of the islands and is clear. Lying 1½ miles southeastward of Amook Island

is a bare rock at the end of a reef extending 200 yards from the eastern shore.

At the south end of these islands there is an inlet in the west shore about ¾ mile long and 300 yards wide, affording anchorage in about 12 fathoms.

Southward of the islands Uyak Bay is 1½ miles to 1 mile wide, and trends 158° true (SE mag.) for 7 miles from the south end of Amook Island. In the last 3 miles of this distance the depths shoal gradually from 20 to 7 fathoms, and anchorage can be selected in any depth desired. The bay then turns to 119° true (E ½ S mag.) for 5 miles, with a width of ¼ to ¾ mile, and is filled by a flat.

Tides.—At Uyak Anchorage high and low water occur about 18 minutes later than at Kodiak, and the mean rise and fall of the tides is 11.5 feet. To find the height of the tide multiply the height of the corresponding tide at Kodiak by the ratio of ranges, 1.67.

DIRECTIONS, UYAK BAY.

From northward, round Cape Ugat at a distance of about 1½ miles and steer 220° true (S by W ½ W mag.) for 6 miles to a position 2½ miles off Cape Kuliuk, bearing 102° true (E by N mag.). Then steer 172° true (SSE ¾ E mag.) for 10 miles, giving the eastern shore a berth of about 2 miles, to a position ½ mile eastward of Harvester Island.

Then steer 237° true (SW by S mag.), passing about ¼ mile southeastward of Harvester Island and heading for an old wharf. Anchor 300 to 500 yards northeastward or northward of the old wharf, in 10 to 14 fathoms.

To go to the inner harbor, follow the preceding directions, and then hauling northwestward keep the western shore aboard distant 250 to 350 yards to avoid the spit extending from the south end of Harvester Island. Then steer 341° true (NW ¼ N mag.) for the northwest end of Harvester Island, pass 150 to 200 yards off the cannery wharf, and continue the course to mid-channel.

From southward, it is said in going from Karluk to Uyak Anchorage that there are no dangers 1 mile offshore. The following are the approximate courses and distances: From a position 1 mile northwestward of Cape Uyak 68° true (NE mag.) for 4½ miles, and then 93° true (ENE ¼ E mag.) for 6 miles passing 1 mile off Rocky Point and Bear Island. When Bear Island bears 180° true (SSE mag.) steer about 124° true (E by S mag.) for 2 miles to a position ½ mile northeastward of Harvester Island. Follow the eastern shore of Harvester Island at a distance of about ½ mile, and proceed as directed in the two paragraphs preceding.

CAPE UYAK TO CAPE KARLUK.

Cape Uyak is a precipitous, high headland at the end of a ridge. From the water the slope is rapid to an elevation of 647 feet. There is then a slight fall to a deep notch in the narrow neck back of the cape, from which there is a rise in steep, grassy slopes to higher land.

Northeast Harbor is a bight about 1 mile long, with a beach of sand and shingle, on the south side of Cape Uyak. It affords anchorage for small vessels in depths of 9 to 15 fathoms, bottom sand and good holding ground, with fair shelter in northeasterly weather.

Between Cape Uyak and Karluk there are two long cliffs about 1,300 feet high, the southern one having a marked slide extending from its highest point almost to the water. In the valley between the cliffs are two waterfalls. There is a house on the bluff near the south fall and a fishermen's camp on the beach near the north one.

Karluk lies 5½ miles southward of Cape Uyak and 1½ miles eastward of Cape Karluk. A hatchery is maintained on Karluk River by the Alaska Packers Association. The entrance to Karluk Lagoon is through a narrow channel at the south end of the spit and is only passable for boats with the water above half tide.

The anchorage off Karluk is an open roadstead, sheltered from easterly winds but exposed to winds from southwest through west to northeast. It should not be used by vessels without power to get away in case of its coming on to blow. Anchorage may be had ⅝ mile northward of the entrance to the lagoon, in depths of 12 to 14 fathoms. The 3-fathom curve lies about 300 yards off the spit, and there are no dangers so far as known in the approach. Uyak Anchorage is the nearest harbor for vessels compelled to leave Karluk from stress of weather.

There is a cliff 820 feet high just west of Karluk, and between this cliff and Cape Karluk is a small bight called **Tanglefoot Bay.** Low land extends through back of Cape Karluk to the beach south of the cape.

Cape Karluk is a prominent, projecting head, 1,438 feet high, with bare rock cliffs on its seaward face and grassy slopes on its eastern side to low land. It is readily identified by its cone-shaped appearance, a notch in the summit, and the low land behind it.

KODIAK ISLAND, SOUTH COAST.

The south coast of Kodiak Island is unsurveyed, with the exception of the west side of Alitak Bay and part of the shore line of Sitkinak Island and the north end of Tugidak Island. The following notes are from reports and should be used with caution. The land is partly wooded for several miles southward from Cape Chiniak and otherwise there are scattered clumps of alders in places in the valleys.

Ugak Island is about 1,200 feet high, with fairly steep sides; bare rocks show for a distance of possibly ½ mile off its eastern side, and breakers at high water were seen for a considerable distance off its western side. There is a low spit on the northwest side of the island; there is a reported anchorage for small craft under the lee of the spit in northeast winds. The **passage between Ugak Island and Narrow Cape** is about 3 miles wide; it is said to have strong currents with heavy rips resembling breakers. The best water is reported to be near Ugak, but it is not recommended for strangers.

Narrow Cape is a flat headland possibly 200 feet high, terminating southward in a vertical face in places. From northward it appears like an island.

Ugak Bay is reported to have good anchorages for small craft at least. The north point at the entrance westward of Narrow Cape is a prominent cliff. The rocks shown on the chart in the north side of the bay westward of the cliff are said to show above water mostly and are easily avoided in clear weather. Small craft have anchored in two coves on the north side of Ugak Bay westward of the valley

leading to Kalsin Bay. A sketch of the south arm shows an anchorage for small craft in the cove which has 7 fathoms shown in its entrance on chart 8502; the depths in the cove are shown as 4 to 6 fathoms, and its west side is shoal. There are portages to Kalsin Bay and Kiliuda Bay, the latter from the native village of **Eagle Harbor.**

Dangerous Cape is said to be a continuous line of bluffs, which should be approached with caution on account of off-lying rocks.

Kiliuda Bay, reported to have several good harbors, is about 17 miles long and has two arms. On the south shore of the western arm are several open bays, some of which may afford anchorage; at the head is an extensive shoal flat. Just westward of Shearwater Bay, there is an open bay with some rocks, the western one about 70 feet high, lying about ¼ mile from shore. About 4 miles westward of the rock there is a sand spit on the north side, about ½ mile long, westward of which anchorage might be obtained in a depth of 10 fathoms.

About 1 mile farther westward is the entrance, ¾ mile wide, to an inlet which extends 2 or 3 miles north-northwestward with high mountains on both sides, their lower parts covered with thick scrub. At the head the inlet shoals abruptly from 25 fathoms. A river empties at the northwest corner and a small creek on the northeast side. Anchorage with good holding ground may be obtained in the middle of the inlet near the head, in 24 fathoms; also in a depth of 15 fathoms in a bay on the south side of the western arm, southward of the entrance to this inlet.

Shearwater Bay, the north arm of Kiliuda Bay, extends about 6 miles in a northerly direction, the land being generally low except on the southeast side, where there are grassy slopes up to high hills. A flat extends 600 yards from the head, which is low and marshy. Secure anchorage may be had in 5 to 6 fathoms, ½ to ⅝ mile from the head, after passing low spits which extend from each side. Rocks awash extend some distance from each side of the entrance, so a mid-channel course should be followed.

Sitkalidak Strait, separating Sitkalidak Island from Kodiak Island, is wide at the entrances, but the through passage is a narrow, tortuous channel which has been used by small local craft of 8 feet or less draft, but is not available for strangers.

Cape Barnabas, the northeast end of **Sitkalidak Island,** is a conspicuous, bold, rocky bluff, surrounded by rocks. A rock on which the sea breaks lies a little over 1 mile northward of the cape.

Port Hobron, the second deep bay from Cape Barnabas on the north side of Sitkalidak Island, is a good harbor for any vessel. Water can be obtained from a mountain stream on the west side near the head.

Newman Bay, on the west side of Sitkalidak Island, is the one shown on chart 8502 with 27 fathoms in the entrance. A sketch of the bay shows the following: A reef extends southward from the north point at the entrance; there is a point, or possibly a spit, on the southeast side of the upper part of the bay; a reef bare at low water lies off the southwest side of the point, and a shoal extends a short distance off its northeast side; there are depths of 8 to 10 fathoms in the bay above the point, and secure anchorage for small craft above the point in the angle between it and the shore; deep water is indicated up the middle of the bay.

Three Saints Bay, on the west side of Sitkalidak Strait, is reported to afford good anchorage for vessels, but is surrounded by high land and is subject to heavy williwaws. A local sketch of Three Saints Bay shows an anchorage for small craft in a lagoon inside of a spit on the west side just inside the entrance. The entrance to the lagoon is around the north end of the spit, and has a depth of 6 fathoms; the depths inside are 8 to 11 fathoms. The sketch also shows a shoal bordering the east side of the spit, and a reef of apparently bare rocks extending southward from the north point at the entrance of the bay.

Old Harbor is on the west side of Sitkalidak Strait about 4 miles northward of Three Saints Bay. The *Albatross* anchored in 7 fathoms in Sitkalidak Strait off the native village. Entering from southward a mid-channel course was followed to the anchorage, the strait being free from hidden dangers except near the shores. Two Headed Island is the best mark for the approach. The country around Old Harbor is mountainous with a narrow belt of level land near the water where the village stands.

Black Point, the south end of Sitkalidak Island, shows darker than its surroundings. There is an islet 200 yards in prolongation of the point, and ¼ mile farther is a rock just above water which marks the end of a ledge extending from the point.

Two Headed Island has two irregularly rounded peaks and is easily recognized. Old sketches indicate some high rocks near the shores. Both sides of the island are said to be clear.

Kaguyak Bay affords anchorage in 6 to 8 fathoms for all winds except from north to east. With northeast winds small craft formerly anchored close under the inner bluff on the east side of the bay. The native village of **Kaguyak** is at the head of the bay. The land is low, except westward of the bay, and the low land extends to Cape Trinity. The south point at the entrance has a reef of bare rocks making off in prolongation of the point, and there is said to be a sunken rock about one-third the distance from the bare rocks to Two Headed Island, the island side being clear.

Cape Trinity, the south end of Kodiak Island, is a tableland of moderate elevation which increases in height very slowly northward and terminates abruptly in rocky cliffs. The shore is fringed with reefs and pinnacle rocks.

Albatross Bank.—While engaged in sealing, Indians reported to Mr. S. Applegate that they saw kelp in the vicinity of the 15-fathom soundings shown on the chart. From bearings on the east end of Sitkinak while at anchor in the vicinity of the reported kelp, and the run of his vessel from that island, the position is placed approximately 27 miles 116° true (E ¼ S mag.) from the east end of Sitkinak Island.

Geese Islands are flattened in appearance, the highest possibly 200 feet, and have no marked feature. **Aiaktalik Island** shows as two flattened knolls, the eastern one the sharper; there is a native village with a Greek church at the southwest end of the bight on the north side of the island. There is foul ground between the islands, and possibly as much as 2 miles in places off their south side. The strait between the islands and Kodiak is obstructed by reefs and is unsafe. A sunken rock has been reported about 2 miles north-northeastward of the northeasternmost island.

Russian Harbor, between Aiaktalik Island and Kodiak, is a temporary anchorage in moderate weather, in about 8 fathoms, hard sand bottom; but there is little shelter, and with strong winds there are

heavy tide rips on account of the strong currents. The little sounding that has been done indicates a broken bottom, and the harbor is not recommended for strangers.

The **cove in Aiaktalik Island** at the village has depths of 2 to 4 fathoms with bowlders in places. It has been used by small craft, but is exposed to northeast winds. An extensive reef, bare at half tide and marked by kelp, extends 5/8 mile northward from the west point of the cove. There is a narrow channel with strong currents between the reef and the point. With northeast or northwest winds small craft anchor close to shore in the bight of Kodiak Island northward of Aiaktalik.

Sitkinak Strait is not surveyed, but is known to be navigable for vessels. In the narrowest part of the strait favor Sitkinak Island, taking care, however, to give it a berth of over 1 mile; the depths are 12 to 17 fathoms. As mentioned above, the vicinity of Geese Islands is foul. A bank of considerable extent, on which the least depth found is 5 fathoms, lies near the middle of the strait off the small island southwestward of Aiaktalik. The reef on which the *Pavlof* struck is reported to lie 2 miles southeastward of the southeast end of Aiaktalik Island. The position is doubtful.

The **currents** in Sitkinak Strait set westward on the flood and eastward on the ebb. There are heavy tide rips in the strait, sometimes in spots southward and westward of Aiaktalik Island, and at times extending in a double line of breakers across to Sitkinak. So far as observed they are heaviest with westerly winds and a flood current. They are often dangerous for small craft, and may at times trouble small vessels.

TRINITY ISLANDS

lie off the south end of Kodiak Island. There are two principa islands, called Sitkinak and Tugidak, which are again divided by lagoons that are navigable only by small boats at high water and have strong currents. The shore line of Sitkinak Island, except for about 6 miles on its southwest side, and the north end of Tugidak Island have been surveyed. The soundings around the islands are from reports.

Fresh water can be obtained from the ravines and pools on the islands. Landing can be made only when the weather is unusually quiet, and the sea makes rapidly. The beaches are generally a heavy shingle. There are a few alder bushes and there is driftwood on the beach. There are no inhabitants except occasionally a few hunters and fishermen in summer. Some prospecting has been done at the southwest end of Tugidak Island.

Sitkinak Island is divided by a lagoon. The eastern part has hills separated by low valleys. A reef extends northeastward from its east end; there are two pairs of bare rocks on the reef, the outer ones 1 mile from shore, and at low water extensive reefs show around them. The south shore of the islands is believed to be foul and should be carefully avoided.

The western and high part of Sitkinak Island is composed of two main ridges separated by a high valley, the easterly ridge having an elevation of about 1,500 feet and the westerly one about 1,200 feet. The north point is low and flat, and is backed by high land which rises steeply. The northwest side of the island is earth cliffs several hundred feet high, broken by narrow ravines, and is foul offshore.

The **passage between Sitkinak and Tugidak Islands** has very strong tidal currents, and its south approach is apparently blocked by shoals.

Tugidak Island, in its northern part, is chiefly sand flats, but little above high water, the higher parts of which are low, grassy sand hills; it is separated from the southern or higher part of the island by lagoons of some depth with strong currents. The western and higher part of the island is earth cliffs from 200 to 400 feet high, from the crest of which the surface slopes gradually to the eastern shore.

In 1909, Mr. S. Applegate located the foul and broken area which extends about 10 miles southward from the south end of Tugidak Island, as shown on chart 8502, by compass bearings on Tugidak Island and the summit of Sitkinak Island. Until a survey is available it is considered unsafe for vessels to cross this area. The bottom is very uneven, the depths changing abruptly from 2 to 4 fathoms in places, and bowlder reefs with little depth may be expected. There are strong currents and heavy rips and overfalls.

The north and west sides of Tugidak Island may be generally approached as close as 1 mile in good weather by a careful use of the lead. Care should be observed near the middle of the west side of Tugidak, as an unsurveyed bank with depths probably as little as 2 fathoms lies some distance off, possibly 2 or 3 miles.

Alitak Bay is described under a separate heading following.

Cape Alitak and Low Cape are determined by triangulation, and the position of the salient points and rocks from the latter to Cape Karluk have been approximately determined, so that fairly good courses can be given. No sounding has been done, and it is advisable to give the points and outer rocks a berth of 2 miles.

The following are approximate **courses and distances** along the coast; allowance should be made for the tidal currents, which have an estimated velocity of 1 to 2 knots at strength, setting along shore, northward on the flood and southward on the ebb:

Passing 2 miles off Cape Karluk, steer 222° true (S by W ¾ W mag.) for 6 miles to a position 2 miles westward of a high, white cliff. Then change to 213° true (S ⅞ W mag.) for 10.5 miles to a position 2 miles westward of the two large and high pinnacle rocks lying ¾ mile westward of the middle ridge northward of Cape Ikolik. Then haul to 191° true (S by E mag.) for 4 miles to a position 2 miles west-southwestward of the outer Seal Rocks off Cape Ikolik. Then steer 152° true (SE ½ E mag.) for 23 miles to a position 2 miles southwestward of Low Cape. Then a 143° true (SE by E ⅜ E mag.) course for 11.5 miles leads to a position 2 miles southwestward of Cape Alitak.

Twin Peaks, described under Alitak Bay, are prominent along the coast as far as Cape Ikolik.

Low Cape, lying 11.5 miles 323° true (NW by W ⅜ W mag.) from Cape Alitak, is the western extremity of the low land in this vicinity. A spit and apparently shoal water extend a considerable distance off the cape, and it should be given a berth of 2 miles. Kelp extends 2 or 3 miles from shore in places in the bight between Cape Alitak and Low Cape. There are high bluffs about 4 miles northward of Low Cape. There is said to be good anchorage in northeasterly winds along the shore between Low Cape and Ayakulik Island.

Ayakulik Island is small and about 350 feet high. **Ayakulik River** makes inland a little southward of the island. Foul ground is reported between Ayakulik Island and Cape Ikolik.

The west end of Kodiak Island consists of three headlands which are the ends of three high ridges. The name Cape Ikolik is here applied to the southerly headland.

Cape Ikolik is marked by two high conical islets close-to, and there are some pinnacle rocks on its south side. **Seal Rocks** are two principal rocks off Cape Ikolik. The inner one, lying about ½ mile west-southwestward of the cape, is a large, steep-sided, bare rock, with a yellowish tinge, and having a nub on top which gives it the appearance of a lighthouse; there is a small, low rock close to its southwest side. The outer **Seal Rocks**, lying nearly 2 miles westward of the cape, is a pinnacle which at a distance resembles a sail; foul ground which does not break is reported to extend about ½ mile outside the rock.

The middle headland lies about 3 miles northward of Cape Ikolik, and there is a large bight between it and the cape. Two large and high pinnacle rocks, one twice as high as the other, lie close together and about ¾ mile westward of this headland.

The northerly headland, lying about 1¼ miles northward of the middle one, is marked by a high, steep-sided, rocky islet, and a number of pinnacle rocks which lie close to shore.

Halibut Bay is the local name of the bight between the headland described in the preceding paragraph and Cape Grant. It is frequently used as an anchorage by fishing vessels in northeasterly winds. The officers of the U. S. S. *Grant* examined the bay, and report that it is sheltered from about north through east to south. Except the reef making off Cape Grant, local pilots report that no dangers exist in the bay. Many soundings taken in the examination showed regular bottom shoaling gradually toward the shore. There is a sand beach at the head of the bay, and a prominent red cliff on its east shore which opens from the south headland of the bay on a bearing of about northeast (mag.). The following are the courses recommended:

Round Cape Grant at a distance of 1 mile, and stand in for the prominent conical peak at the head of the bay. When the red cliff bears 43° true (N by E ¾ E mag.) haul up for it parallel to the sand beach, and anchor about ½ mile from the red cliff in 10 to 12 fathoms.

Cape Grant lies about 10 miles southward of Cape Karluk and about 6 miles northward of the two large and high pinnacle rocks, lying off the middle headland previously described. The cape is a rugged headland at the end of a high ridge, the summit of which is marked by a small cluster of peculiar pinnacle rocks. A reef which breaks in heavy weather extends possibly ½ mile off the cape.

A headland of high, white cliffs lies about 4 miles northward of Cape Grant and about 6 miles southward of Cape Karluk. The cliffs are at the end of a fairly level ridge which extends some distance back with an estimated elevation of 1,200 feet.

ALITAK BAY,

at the south end of Kodiak Island, is about 7 miles wide at the entrance between Cape Alitak and Cape Trinity, and in its length of about 13 miles in a north-northeasterly direction the bay narrows to about 4 miles at the entrance to its northerly arm, called Deadman Bay. Lazy Bay is a good anchorage convenient to Cape Alitak,

and there is a cannery in Olga Bay at the head of the northwest arm of Alitak Bay.

The west side of Alitak Bay from Cape Alitak to the entrance of the narrows leading to Olga Bay has been surveyed, although the soundings are not sufficient to develop all dangers, especially in the open waters of Alitak Bay.

There are no trees, the largest growth being scattered clumps of alders. Except the beaches and the outcropping ledges of bare rock on the knolls and peaks, the land is covered with thick moss and grass; there are lakes in places and numerous streams. The prominent feature in the approach is Twin Peaks, on the peninsula between Lazy Bay and Kempff Bay, which can be seen from Cape Ikolik on a clear day. The peninsula between Kempff Bay and Olga Bay is broken by mountain masses rising to a height of about 2,000 feet.

The eastern shore of Alitak Bay consists of high bluffs, terminating in Cape Trinity. No sounding has been done.

Cape Alitak is the south end of a sloping ridge with numerous knolls, which is partly grass covered but has much bare rock. The cape slopes upward gradually to Tanner Head, a rocky knoll about 600 feet high, between which and Twin Peaks there is a break formed by Lazy Bay.

A shoal, apparently of sand and with a very uniform bottom, extends from the southeast side of Cape Alitak toward Cape Trinity; the 3-fathom curve on the shoal is about ½ mile from shore for a distance of 1¼ miles northward of Cape Alitak, and the 5-fathom curve is about 1½ miles from shore. Heavy tide rips are frequent off the cape. It is reported that this shoal extends across to Cape Trinity; a depth of 7 fathoms was found on it at the limit of the survey, 2 miles southeastward from Cape Alitak, and a depth of 8 fathoms was reported by U. S. S. *Ranger* about 3 miles southeastward of that cape.

Lazy Bay, lying 4 miles northward of Cape Alitak, is well marked by Twin Peaks and Egg Island on its north side, and there is a bare, white, flat ledge close to its south entrance point. The shore southward of the entrance is clear if given a berth of ⅜ mile, with the exception of the shoal making off the southeast side of Cape Alitak. Approaching from northward in Alitak Bay, vessels can haul in for the entrance when Egg Island bears 270° true (WSW mag.).

Entering in mid-channel, good anchorage for vessels can be had ½ to ⅝ mile from the head of Lazy Bay, and midway between the sandspit on the north shore and a dark, bare rock on the south shore, in 7 to 9 fathoms, sticky bottom. A narrow ridge on which the least depths found are 5 to 6 fathoms extends across Lazy Bay in a northnortheasterly (mag.) direction from the rock (covered at three-quarters flood), on the east side at the entrance to Rodman Reach. A flat extends ⅜ mile from the head of the bay, and the shores at the anchorage should not be approached closely. Water can be obtained from a stream on the north shore just inside the spit.

Rodman Reach is a narrow arm which extends southward from Lazy Bay and inside of Tanner Head to Cape Alitak, where it forms a shoal basin from which another narrow arm extends some distance northwestward, being separated from the sea by a narrow shingle spit. The depths are 4 to 5 fathoms, hard bottom, in the channel for a distance of ½ mile from the entrance, and a spit projects from

its west side just inside the entrance; the channel of this part of the reach might be used as an anchorage for small craft. No further soundings are available.

Egg Island is a small rocky island about 15 feet high lying on the north side at the entrance to Lazy Bay. The passage inside the island is foul, and foul ground with rocks bare at low water extends 600 yards northward toward the rocky islet off the south side of Kempff Bay.

Twin Peaks, between Lazy Bay and Kempff Bay, are about 1,000 feet high, and are the most conspicuous mark from westward as far north as Cape Ikolik, being first raised as an island.

Kempff Bay, on the north side of Twin Peaks, has too deep water for convenient anchorage, and its north shore has broken ground which should be avoided. Favoring somewhat the south shore through the bay, anchorage can be selected in the middle about ⅜ mile from the head, in 18 fathoms; a spit with deep water close-to extends 350 yards from the north shore at a point ¾ mile from the head. For the purpose probably of communicating with Akhiok, small craft have used an anchorage in the middle of the first large bight on the north side of Kempff Bay ¾ mile above the small island on the north side of the entrance; there is broken ground, which has not been fully developed, making well off the shores of the bight.

A reef, covered at high water and with a rocky islet a few feet high near its end, extends ½ mile from the shore just southward of Kempff Bay; the islet should be given a berth of over ¼ mile, passing eastward of it in Alitak Bay, and northward of it when entering Kempff Bay.

Between Kempff Bay and Moser Bay, a distance of 4 miles, the shore is fronted by islands and rocks about 1 mile wide, the shores of which are fringed with reefs. **Akhiok** is a native village on the shore 1¼ miles north-northwestward of Round Hill.

Round Hill, about 180 feet high, is on the east end of the large island forming the north side of Kempff Bay. It is a small symmetrical grassy knoll, and is quite distinctive. An extensive reef, with a few heads, which always show, extends ⅜ mile off the east side of the north end of the island at Round Hill.

The principal **outlying dangers**, so far as known, in Alitak Bay lie eastward of the islands and rocks between Kempff Bay and Moser Bay. They are in the form of long ridges trending with the bay, the two on the west side lying nearly ¾ mile and 1½ miles from the islands and rocks on the west side; and the deepest and clearest channel in the bay lies between the second ridge and Middle Reef, the latter being a third ridge.

The first ridge lies on a 33° true (N ⅞ E mag.) bearing to High Rock, and the following are the shoaler places determined on it; it should not be crossed except with caution.

A 12-fathom sounding, not developed, lies 95° true (ENE ⅜ E mag.) from the south Twin Peak and 1½ miles 179° true (SSE ⅛ E mag.) from Round Hill; it is apparently the south end of the first ridge.

A reef, covered at highest tides, lies ⅞ mile 136° true (ESE mag.) from Round Hill, with foul ground between.

A reef, ½ mile long on the line of the ridge, partly bare at low water and marked by kelp, lies ¾ mile off the island northward of Round

Hill, with foul ground between, and lies between the bearings 93° true (ENE ¼ E mag.) and 73° true (NE ⅜ E mag.) from Round Hill.

A 9-fathom sounding, not developed, lies ¾ mile northward of the preceding reef, about the same distance from the nearest island westward, and bears 175° true (SSE ½ E mag.) from the northeast end of the island on the south side of the entrance to Moser Bay; it is apparently the north end of the first ridge.

The least depth found on the second ridge is a 10-fathom sounding which lies 1¾ miles 143° true (SE by E ⅜ E mag.) from Round Hill. Other soundings on this ridge are 14 fathoms ½ mile southward, and 16 fathoms ⅝ mile northward, of the 10-fathom sounding, with no development.

Middle Reef, about ⅜ mile long and covered at about half tide, lies 3⅝ miles 100° true (ENE ⅞ E mag.) from Round Hill; a rock bare at low water lies ½ mile eastward of Middle Reef. Broken ground which has not been developed extends 1 mile northeastward and 2 miles southward from Middle Reef; a rock, bare at a good low water and not located, was seen well southward of Middle Reef, possibly as much as 1 mile.

Deadman Bay, the northerly arm of Alitak Bay eastward of Moser Bay, is not surveyed. On its western side is a flat island about 40 feet high, and there are some islets and rocks between it and the western shore. The peninsula between Deadman Bay and Moser Bay is a high grassy ridge with a number of summits, and it slopes gradually southward.

High Rock is a steep-sided, flat islet, with grass on top and a split in the middle, which lies 200 yards off the southeast end of the peninsula between Deadman and Moser Bays. From southward it shows as a small bluff against the low shore northward. A kelp-marked reef, partly bare at low water, extends ⅜ mile southward from High Rock. Another reef, partly bare at low water, lies ⅜ mile eastward of High Rock.

Moser Bay, the large northwest arm of Alitak Bay, has depths of 10 to 14 fathoms, soft bottom, and is a secure harbor. The entrance is nearly ½ mile wide between a sand spit on the north and a low rocky island on the south. It is obstructed by a rocky shoal which extends northward from the island, the northerly end of the shoal with depths of 3 to 4 fathoms, lying 300 to 600 yards westward of the sand spit. There is less depth on the shoal for one-half the width of the entrance from the island, and little depth near the island. The deepest channel (over 5 fathoms) lies 100 to 250 yards off the west side of the sand spit. From the sand spit eastward toward High Rock the 3-fathom curve is about 250 yards from shore. A kelp-marked reef also extends ¼ mile eastward from the island on the south side at the entrance to Moser Bay.

The tidal **currents** are strong with swirls in the entrance of Moser Bay, and rips occur at times with a fresh wind opposing the current; but these rips do not compare in magnitude with the heavy ones which occur in Sitkinak Strait and off the mouth of Alitak Bay.

About one-half the distance from the entrance of Moser Bay to Point Fassett there is a shoal or reef which extends halfway across from the northeast shore of Moser Bay toward a spit on the southwest

shore. The shoal has depths of 4 to 9 feet on it for a distance of ⅜ mile from shore, and a depth of 3 fathoms was found on its outer part.

A shoal bare at low water extends ¼ mile east-northeastward from a spit on the southwest shore opposite the preceding shoal.

Point Fassett, a low grassy head with lower land back of it, is the turning point on the northeast side of Moser Bay nearly 2 miles inside the entrance. A shoal makes off from the eastern shore between Point Fassett and the Narrows, the greatest distance being ¼ mile in the bight between them and extending with this width nearly to the Narrows.

Snug Harbor, the cove southwestward of Point Fassett, has a depth of about 12 fathoms in the entrance and shoals gradually westward. It is clear with the exception of a flat which extends nearly ¼ mile from its head. A valley between mountains extends through from Snug Harbor to the sea.

Chips Cove, on the west shore of Moser Bay 1½ miles northward of Point Fassett, has a depth of about 8 fathoms in its entrance. Shoals extend from the shores of the cove, and a flat extends about ⅜ mile from its head. Vessels can anchor off the entrance, favoring slightly the western shore of Moser Bay, and a small vessel and small craft can select anchorage near the middle of the cove.

The Narrows.—About 1 mile northward of Chips Cove is the south entrance to the Narrows which leads to Olga Bay. They are about 1 mile long and in the narrowest part about 300 feet wide. The channel is tortuous with many rocks, some bare at low water and others which are only apparent by the heavy swirls over them when the current is running. The small cannery steamers use the Narrows, but local knowledge is necessary and a large vessel should not attempt it. With the current running full the cannery steamers wait for slack water, which occurs 2 hours after high and low water at Snug Harbor. The current at its greatest velocity probably reaches 8 knots. It is said that 3½ fathoms can be carried through the channel at low water, but this statement should be received with caution.

Olga Bay is an irregularly shaped body of water, 17 to 18 miles long and ½ mile to 2 miles wide. The western end is the largest and is separated from the sea, about 6 miles northward of Low Cape, by a strip of low land only ¾ mile wide. The bay has the appearance of a lake, and the rise and fall of tide varies from 1 to 2 feet at the cannery, which is at the entrance of the stream on the north shore about 10 miles northwestward of the Narrows.

DIRECTIONS, ALITAK BAY.

Approaching through Sitkinak Strait, note the description of the strait preceding. Approaching from northwestward, courses are given in the description of the coast preceding.

From southwestward.—U. S. S. *Ranger* passed 8 miles off the northwest shore of Tugidak Island on a 43° true (N by E ¾ E mag.) course, with soundings of 15 to 20 fathoms over an even bottom of sand and gravel. When the north end of the higher part of Tugidak bore 166° true (SE ¾ S mag.), distant 9 miles, 27 fathoms was found, broken shell bottom. The course was then changed to 76° true (NE ¾ E mag.), and the water suddenly deepened from 32 fathoms

to 42 fathoms, rocky bottom. This depth was carried with the same character of bottom until Cape Alitak bore 355° true (NNW ½ W mag.), distant 3¾ miles, when 29 fathoms, gray sand and shell, was found. The water then shoaled quickly and the ship anchored in 9 fathoms, with Cape Alitak bearing 318° true (NW by W ¾ W mag.), distant 3 miles.

The shoal across the entrance to Alitak Bay is described in the paragraph following Cape Alitak, preceding. Passing 2 miles east-southeastward of the cape should lead across the shoal in a least depth of 6 to 7 fathoms. The principal shoals, so far as known, in Alitak Bay are in long ridges trending with the bay and lie abreast the islands and rocks between Kempff Bay and Moser Bay, as described in the paragraphs following Round Hill, and including Middle Reef. The following courses lead in the best water, as determined by the survey:

With Cape Alitak bearing 315° true (WNW mag.), distant 2 miles, steer 45° true (NNE mag.) for 7 miles to a position with a reef covered at high water in range with Round Hill, bearing on the port beam, the reef distant 1¼ miles and the hill distant 2⅛ miles.

Then steer 15° true (N ¾ W mag.) for 3 miles, heading for High Rock, until 1 mile from it, and then steer 338° true (NW mag.) and pass 200 to 300 yards southwestward of the sandspit on the north side at the entrance to Moser Bay.

When the sandspit is well abaft the beam, haul westward for the south side of Snug Harbor, which will lead southward of the shoal making off from the north shore, 1 mile westward of the entrance; a 320° true (NW by W ⅝ W mag.) course, with the south point at the entrance to Moser Bay astern, will lead midway between the shoal and the end of the spit on the south shore. Above the shoal there are no dangers, but the west shore should be favored somewhat from Point Fassett to the entrance of Chips Cove.

CHIRIKOF ISLAND (CHARTS 8881, 9196),

lies about 60 miles south-southwestward of the Trinity Islands. The southern part of the island has bold, high peaks and bluffs, from which it gradually slopes to the north end, terminating in a low, green, undulating country. There is an islet near the southeast end. The island is easily recognized at night unless fog-covered.

Anchorage may be found in the bight at the southwest corner (Southwest Anchorage, chart 9196), at the mouth of the stream and opposite the houses; or in 10 fathoms on the west side off the bluff just south of the stream, possibly 2 miles from the northwest point. There is foul ground between Chirikof Island and the islets west of it. These islets are known as Nagai Rocks; the largest, Round Rock, appears like a haystack.

A shoal is reported to extend from the east side near the middle of the island; the *Albatross* reported breakers 3 miles 114° true (E ¼ S mag.) from the middle of the island. A breaker is reported in an estimated position 4 miles east-southeastward from the southeast point of the island. A shoal with kelp is reported to extend about 1 mile westward from the northwest point of the island.

SEMIDI ISLANDS (CHART 8881),

consisting of two large and seven small islands, are 1,200 to 1,500 feet high with bold shores and may be safely approached as the soundings are deep. There are strong tidal currents among the islands, which form bad tide rips in the channels and off the points. The breaker shown southwestward of **Chowiet Island** is reported by some navigators to lie much closer in than charted.

Small sealing schooners formerly anchored in the coves at the southwest end, east side, and in both coves in the bight on the northwest side of Chowiet Island; on the south side of **Kateekuk Island**, and on the east side, near the north end, of **Aghiyuk Island**. Vessels of the Coast Guard have reported that the anchorages on the east side near the north end, and on the northwest side of Chowiet Island are available shelters in westerly and easterly gales, respectively.

Lighthouse Rocks, lying about 30 miles southwestward of Chowiet Island, consist of several detached, barren rocks, occupying an area about ¼ mile in diameter. The largest rock is 500 feet long and 90 feet high. They can be approached as close as ½ mile with safety. There is a large sea-lion rookery on the rocks.

Currents.—Between Sitkinak and Chirikof Islands the general set of the current is reported to be about 249° true (SW ⅛ W mag.), 0.5 knot. There is a current between Chirikof Island and Lighthouse Rocks, with a southerly set, less than 0.5 knot. From Lighthouse Rocks to Kupreanof Point the current sets generally 260° true (SW by W ¼ W mag.) and varies from 0.3 to 0.7 knot.

ALASKA PENINSULA.

General Remarks.—The south coast of the Alaska Peninsula, from Cape Douglas to Cape Pankof, has a length of about 425 miles. It is irregular and greatly broken by numerous indentations affording anchorages. Many of its points are rugged cliffs of great height which can not be approached too closely on account of reefs at the bases of them, while others are low with more or less shoal water off them.

The mountains on the peninsula are high, irregular and bold, and many of the peaks reach heights of 2,000 to 9,000 feet.

Pavlof Volcano, the most prominent of several on the peninsula, is about 9,000 feet high, lies on the west side of Pavlof Bay, and has three peaks lying in a general north and south line, the middle one being the highest. These peaks are very symmetrical. Smoke is frequently seen issuing from the central one.

Frosty Peak, a noticeable snow-capped mountain near the southwest end of the peninsula, is 5,800 feet high; it is not very regular in outline and has several peaks, one of which, however, rises above the others.

Many lakes and sizable streams are found inland and there are several portages across the peninsula and between the adjacent bays.

Many settlements, canneries, and fishing stations are scattered along the coast and among the off-lying islands.

There are numerous off-lying islands and groups of islands with navigable passages between, and good harbors on their coasts.

The **weather** along the Alaska Peninsula is moist and cool throughout the year. Rain and snow falls are excessive and there are long periods of rainy, moist, and cloudy weather. Snow may fall at the water level until June and on the peaks until late in the summer. It extends far down the slopes at the close of September and may be expected at the water level early in October. Fog and mist may be expected at any time from spring until fall and often last for several days.

Fog.—No really thick fog was met with in 1913 and 1914, although the surveying vessel was moving actively about in all parts of the region during both seasons. It proved possible to navigate safely at all times, although misty and moderately thick weather frequently prevailed. Kupreanof Point and Cape Pankof are often enveloped in fog banks, and occasionally in dense fog.

Winds.—There are no prevailing winds. In the early part of the summer southerly winds are more frequent, in mid-summer southeast winds, and in October and November northerly winds. All winds bring mist and rain except west-southwest to north, an on-shore wind brings mist and rain, and an off-shore wind clearing weather. The mist and fog are thicker on the weather side of the land, and lift to leeward. Thus a landfall may almost always be made on the lee side of the land.

The **tidal currents** are weak, probably never exceeding 1½ knots. There is a continuous current westward along the mainland, which becomes stronger on the approach of a northeast storm, and is often the best warning of such a storm. Westerly winds weaken the current. The barometer indicates that some storms reach this coast from the south or southeast, while others are typical cyclonic storms approaching from the west.

Kelp.—The navigator can not rely on seeing kelp on rocks and shoals; many rocks and gravel banks bear no kelp, especially early or late in the summer. Many others have only a light growth of thin ribbon kelp which can not be seen until the vessel's stem enters it, and which is often drawn under by a current or sea.

Commerce.—There is only one small steamer which makes regular trips along this coast. Stops are made regularly at the post offices at Chignik, Unga, Sand Point, Belkofski, and Kings Cove; stops are made at other places on payment of a bonus. Many other irregular vessels use the south Alaska Peninsula passage, however, in voyages between southeast Alaska and Bering Sea.

Local attraction has been reported in the vicinity of Arch Point, in the passage between Dolgoi and Goloi Islands, and off Kings Cove.

DIRECTIONS, CAPE IKTI TO CAPE KALEKTA.

For a vessel bound westward along the south coast of the Alaska Peninsula there exists an **inside passage from Mitrofania Island to Cape Pankof,** 195 miles in length, measured along the usual steamer tracks. This passage is used entirely or in part by the majority of vessels navigating between these points. While it has been by no means completely surveyed, many soundings have been taken upon it and the points of departure have been accurately located. A careful navigator may safely follow it except with a vessel of the deepest draft, if he observes the directions given. However, a

large vessel of good power would undoubtedly find it better to keep to the open sea; while a vessel of 2,000 tons or less would probably be favored more by the shelter of the islands and numerous harbors. The passage is exposed at several places to the open sea, but for the greater part of the way is effectively protected by islands and reefs.

The channels have no characteristic formation or direction; the depth is less than 100 fathoms at all points, and the bottom is extremely irregular and rocky in most places. At several critical points a good location may be obtained with a hand lead. Many of the points of departure are rugged cliffs of great height, which can not, however, be approached too closely on account of reefs at the bases of them; while others are low sand points with more or less shoal water off them. The passage follows the mainland coast almost invariably, passing inside of almost all of the islands.

The islands are 1,200 to 2,000 feet high, while the mainland has peaks near the sea 2,000 to 8,000 feet high. The land has no timber whatever upon it, but in the months of July and August bears a heavy growth of grass. The snow line in these months is at about 2,500 feet elevation.

Cape Ikti to Kupreanof Point.—The following courses are recommended because lines of soundings have been run upon them, which would indicate that they are safe.

Pass 1.6 miles off Cape Ikti and steer 252° true (SW $\frac{5}{8}$ W mag.) for 6.5 miles, with the north end of Mitrofania Island ahead. When the southeastern point of Mitrofania Peninsula is abeam, 1.5 miles distant, steer 285° true (W $\frac{3}{8}$ S mag.) 7.3 miles, for the river mouth, which is near the foot of the hills northeastward of Long Beach. Run $\frac{3}{4}$ mile after the west ends of Little Brother Island and Mitrofania Island are in range, and when Long Beach is 0.9 miles distant steer 195° true (S $\frac{1}{2}$ E mag.) for 3.1 miles and pass 0.9 mile off the next point, passing midway between Little Brother Island and the mainland, and heading about 1 mile to westward of Mitrofania Island. Then steer 242° true (SW $\frac{1}{4}$ S mag.) for 4.6 miles, heading for the south part of Chiachi Island, and passing 1 mile off Coal Cape.

With Coal Cape bearing 0° true (N by W $\frac{3}{4}$ W mag.) 1 mile distant, steer 301° true (W by N mag.) for 3.6 miles, heading for Perry village. When the west tangent of Shapka Island is abeam, 1 mile distant, and closed on Chiachi Island, steer 236° true (SW $\frac{3}{4}$ S mag.) for 10.7 miles, passing midway between Three Star Point and Chiachi Island; on this course pass 0.2 mile off Paul Island, nearer to it than to Egg Island, and avoid the reef which extends from Egg Island; there is 7 fathoms, gravel bottom, abreast of Egg Island on this course, and the tangent of Alexander Point is right ahead. When past Paul Island, with the west tangent of it abeam, steer 204° true (S $\frac{1}{2}$ W mag.) for 16.2 miles, passing 0.7 mile eastward of Leader Island, 1.2 miles eastward of Fox Cape, and 1 mile off Kupreanof Point.

To enter Kupreanof Harbor, steer 90° true (ENE $\frac{1}{4}$ E mag.) through the middle of the westerly entrance, and when the northern point at the entrance is abeam 0.3 mile distant steer 45° true (NNE $\frac{1}{4}$ E mag.), with the peak of Paul Island ahead and Leader Island in range with the tangent of Jacob Island astern. When the east entrance between Paul and Jacob Islands is about to open, anchor in

10 fathoms with the two points of this eastern entrance in range. This is the best harbor in this part of the peninsula.

Kupreanof Point to Unga Strait.—From a position 1 mile south-southeastward of Kupreanof Point steer 267° true (WSW mag.) for 15.4 miles to a position 1 mile north-northwestward of Karpa Island; then steer 248° true (SW ⅜ W mag.) for 18.2 miles to Cape Swedania, bearing 0° true (N by W ¾ W mag.), distant 3 miles. From here steer 270° true (WSW ¼ W mag.) for 6.7 miles, passing 0.9 mile off Gull Island, to Unga Strait, with the low sandy point on Unga Island abeam 0.9 mile distant. Soundings were made upon these courses, and they appear safe.

A rock (E. D.) has been charted northward of Karpa Island, and there is undoubtedly broken bottom northward of Korovin Island, although of greater depth than pinnacles are generally found in. Therefore most vessels steer 238° true (SW ⅝ S mag.) for 22 miles from Kupreanof Point abeam to the middle of Gorman Strait; then round Cape Devine, and with it bearing 333° true (NW ⅛ W mag.), 1.4 miles distant, steer 280° true (W ⅞ S mag.) for 6.5 miles to Korovin Strait; then with High Island abeam, 0.9 mile distant, steer 290° true (W ⅛ N mag.) for 8.2 miles to the above position off Cape Swedania, and follow the directions in the preceding paragraph.

A portion of this track has already been surveyed, and it is for that reason safer; but Gorman Strait is a poor mark in bad weather; there are dangerous rocks on both sides of it, and there are variable currents across the course from Kupreanof Point. Therefore some navigators might be led to choose the shorter and easier route, hence directions are given for it.

Gorman Strait to Unga.—From a position in the middle of Gorman Strait, a 220° true (S by W ⅞ W mag.) course for 10 miles leads 1 mile east-southeastward of Popof Head. If bound to Sand Point, round Popof Head at a distance of 1 mile; then follow the directions for entering Popof Strait from eastward. If bound to Unga, steer 235° true (SW ⅞ S mag.) for 6.6 miles to Halfway Rock bearing 0° true (N by W ¾ W mag.), distant ¾ mile; then follow the directions for entering Delarof Harbor.

With Cape Swedania bearing 0° true (N by W ¾ W mag.), distant 3 miles, steer 270° true (WSW ¼ W mag.) for 6.7 miles, passing 0.9 mile off Gull Island, to Unga Strait, with the low sandy point on Unga Island abeam 0.9 mile distant.

To pass through West Nagai Strait.—From a position with Kupreanof Point bearing 294° true (W ⅜ N mag.), distant 1 mile, steer 220° true (S by W ⅞ W mag.) for 24 miles to a position 1 mile 130° true (ESE ⅛ E mag.) from the south point of the southeast island of the Haystacks. **If bound to Unga,** change to 251° true (SW ⅝ W mag.) for 16.4 miles to a position ¾ mile 180° true (S by E ¾ E mag.) from Halfway Rock; then follow directions for entering Delarof Harbor.

If bound to Sand Point.—From the position 1 mile 130° true (ESE ⅛ E mag.) from the southeast island of the Haystacks, steer 261° true (SW by W ½ W mag.) for 11.4 miles to a position 1 mile southward of Popof Head; then follow directions for entering Popof Strait from the eastward.

Unga Strait to Arch Point.—From the position in Unga Strait, 0.9 mile 0° true (N by W ¾ W mag.) from the low sandy point on Unga

Island, steer 246° true (SW ⅛ W mag.) for 15.8 miles, with Cape Swedania astern, to Jude Island abeam, distant 3.4 miles. Then steer 270° true (WSW ¼ W mag.) for 13 miles, passing 1.8 miles off the point east of Hair Seal Cape, the same distance off Moses Rock, to a position with the west tangent of Cape Tolstoi abeam 3.6 miles distant. Then steer 241° true (SW ¼ S mag.) for 15.8 miles to pass 1½ miles off Ukolnoi Island, and 0.4 mile off and 1 mile beyond Arch Point.

There is a 5¾-fathom shoal 0.8 mile off Arch Point; and about halfway between Arch Point and Dolgoi Island is a shoal with 11 feet. Arch Point has deep water close-to.

If desired, one may leave the same point of departure in Unga Strait and steer 253° true (SW ¾ W mag.) for 33.9 miles to the northwest point of Ukolnoi Island abeam, 0.8 mile distant; then steer 245° true (SW ⅛ W mag.) for 8.9 miles to pass the same distance off Arch Point. This course passes 0.9 mile off shore on approaching Hair Seal Cape. At the point of departure in Unga Strait the depth is 24 fathoms, increasing to 60 fathoms off Beaver Bay; a few miles farther the depth decreases to 10 fathoms, and approaching Hair Seal Cape it increases again to 15 fathoms. From Cape Tolstoi southwestward, and off Ukolnoi Island, the depth is 50 to 60 fathoms.

Arch Point to Stag Point.—From a position 1 mile southwestward from Arch Point steer 180° true (S by E ⅝ E mag.) for 4 miles with the sand spit at the northwest end of Goloi Island in range with the middle of Iliasik Strait, until the sand spit at the easterly end of Moss Cape is a little abaft the beam, 0.6 mile distant. Then steer 207° true (S ¾ W mag.) for 0.9 mile, heading for the northwest point of Inner Iliasik Island, avoiding a kelp-marked shoal which extends about 0.4 mile from shore on the south side of the sand spit at the easterly end of Moss Cape, and passing 0.4 mile westward of the sand spit at the northwest end of Goloi Island. Rocks extend 400 yards off the southwest side of Goloi Island at a distance of ½ mile southeastward of the spit.

Then steer 168° true (SSE ¾ E mag.) for 4.4 miles with the end of the sand spit at the east end of Moss Cape astern and the highest point of the ridge across the north end of Outer Iliasik Island ahead, to a point opposite the middle of Iliasik Strait. Approaching Iliasik Strait, rocks lying 0.3 mile southwestward of the northwest part of Outer Iliasik appear to be in mid-channel, but as the course is continued the channel opens out north of them. Open out the channel well before passing through from either side. The best course is about south-southwest (mag.) through the middle of the strait, with the north point of the entrance to Dolgoi Harbor astern. The strait is 1.1 miles wide and has a clear width of nearly ½ mile. A partly bare reef extends 0.3 mile off the northwest side of the strait, and a shelving shoal extends 0.4 mile off the sand spit at the northwest end of Outer Iliasik Island.

From Iliasik Strait steer 263° true (SW by W ¾ W mag.) for 13.3 miles, passing ⅞ mile south of Cape Bold and ⅞ mile north and 0.3 mile beyond Stag Point, with the north tangent of Outer Iliasik astern. From Iliasik Strait to Stag Point there is from 10 to 50 fathoms.

Stag Point to Cape Pankof.—Then steer 244° true (SW mag.) for 5.1 miles to a point ½ mile off the northwest point of Fox Island and

with a stern range on a large rock a few yards off Cape Bold. Then steer 229° true (SSW ¾ W mag.) for 13⅞ miles to Umga Island ⅞ mile abeam to southward. There is a 3-fathom shoal 3 miles 247° true (SW ⅜ W mag.) from West Cape, Deer Island; the course passes ¾ mile northward of it. After passing Fox Island the bottom shoals to 6 fathoms over the bar off Thin Point, and then deepens to 30 fathoms near Umga Island. (See the description of the shoal extending from Thin Point to Deer Island on p. 187.)

Then steer 226° true (SSW ⅜ W mag.) for 14.2 miles, which should lead to a position 1½ miles 136° true (SE by E ½ E mag.) from Cape Pankof. On this course Pankof Breaker should be left 2¼ miles on the starboard hand.

Cape Pankof through Unimak Pass to Cape Kalekta.—From a position 1½ miles 136° true (SE by E ½ E mag.) of Cape Pankof make good a 253° true (SW ⅞ W mag.) course. The southernmost pinnacle rock at Cape Lazaref should be left about 3¼ miles on the starboard hand, and the coast of the southern end of Unimak Island should be given a berth of about 2 miles. This course made good for 58 miles should lead to a position with Seal Cape on the starboard beam distant 2½ miles.

When crossing Unimak Pass the tidal current with a maximum velocity at strength of about 4 knots will be on the bow or quarter, and allowance must be made for it to make the course good (see p. 197).

From a position 2½ miles southeastward of Seal Cape make good a 268° true (WSW ¼ W mag.) course for 36 miles, which should lead to a position 2 miles north-northwestward from Akun Head. The course should lead 2 miles northward of the eastern headland at the north end of Akun Island when 5 miles from Akun Head.

From a position 2 miles north-northwestward from Akun Head make good a 249° true (SW ⅝ W mag.) course for 14 miles to a position with the western head at the north end of Akutan Island bearing 141° true (SE by E mag.) distant 2 miles.

From this position make good a 224° true (SSW ⅜ W mag.) course for 18½ miles, which should lead to a position about 1 mile northwestward of Cape Kalekta. In crossing from Akutan Island to Cape Kalekta care should be taken not to be set off the course by the tidal currents setting to or from Akutan and Unalga Passes.

SHAW ISLAND TO TAKLI ISLAND.

Shaw Island lies 10 miles northwestward from Cape Douglas and 1¾ miles from shore. It is ⅝ mile long, about 50 feet high, flat and grass covered. A depth of 12 fathoms was found midway between it and the shore. Ledges extend northwestward from the island to a greatest distance of ¾ mile from its northern end.

The two bluff points 1¾ miles southward and 5 miles southeastward of Shaw Island are the ends of two sharp, rocky ridges extending from the high land of Mount Douglas. Anchorage can be had in the bight between the points in 13 to 15 fathoms, sandy bottom, with shelter from southerly and westerly winds, but the williwaws are bad during westerly gales. At the head of the bight is a short valley with a glacier. Just clear of the bluff point at the southeast

end of the bight is a pinnacle rock about as high as the bluff. The bight southeastward of this last point appears shoal.

Sukoi Bay, on the north side of Cape Douglas, is shoal and can be used only by small craft with local knowledge. There are rocks bare at low water in the middle of the entrance, and a ledge bare at low water between the rocks and the south shore.

Cape Douglas is a grassy peninsula about 3 miles long and 190 feet high. At its western end it breaks off in a bluff to a low, narrow neck which connects it to the mainland. Rocks bare at low water extend about ½ mile eastward from the cape.

The bight south of the neck back of Cape Douglas is an anchorage sheltered from northerly and westerly winds. There is some shelter from northeasterly winds, but if heavy, some swell rolls around the point. A stream enters the northeast end of the bight at the foot of the bluff, and this part of the bight is dry at low water nearly out to the southwest end of Cape Douglas. The anchorage is in the middle of the bight, with the two points on the south side of Cape Douglas in range, bearing 114° true (E mag.), in 6 fathoms, sandy bottom.

Douglas Reef, lying 5½ miles 187° true (S by E ½ E mag.) from Cape Douglas, is about 2 miles long north and south. The reef is partly bare at low water, and near its middle is a rock 28 feet high. A sounding of 6¾ fathoms with 40 to 60 fathoms close-to was found 1 mile 81° true (NE by E mag.) from the rock, and vessels should not approach it closer.

Two rocks, close together and awash at high water, lie 2¾ miles southwestward of Douglas Reef and 1½ miles from shore. A reef bare at low water extends about ¾ mile southeastward from them.

About 10 miles southward of Cape Douglas is a point marked by a hill 673 feet high. There is a small glacier in the valley south of the point. Lying 1¼ miles from the point and 168° true (SE ¾ S mag.) from the hill there is a rock awash at about half tide. There is no kelp on the rock, and the sea seldom breaks on it when it is covered.

Two kelp patches lie about 1½ miles southward of the preceding rock and the same distance from shore. The kelp shows well at low water only, and the sea seldom breaks on the rocks. The eastern patch lies 193° true (S by E mag.) from the hill mentioned in the preceding paragraph.

Kiukpalik Island lies 17½ miles southward of Cape Douglas and 2 miles from shore. It is 1¼ miles long, 155 feet high, nearly level and grass covered. A shoal scantily marked by kelp lies about ½ mile 339° true (NW mag.) from the north end of the island, and there is no safe channel between them. A temporary anchorage with shelter from easterly winds may be had in the bight on the west side near the south end of the island, in 8 or 9 fathoms, muddy bottom. The shore of the mainland inside the island should be avoided, as there is a possibility of shoals on that side.

Shakun Rock, a prominent, dark pinnacle 50 feet high, lies 5 miles 232° true (SSW ½ W mag.) from Kiukpalik Island. From the rock a semicircular reef, partly bare at low water, extends southward and westward to the south end of a chain of grass-covered islets. There is foul ground between Shakun Rock and the islets,

and the latter are apparently connected with the shore northwestward by a reef.

Swikshak Bay is a lagoon which is practically closed at all stages of the tide. The entrance lies at the west end and is about 200 feet wide.

Kaguyak is a village behind a large, bare rock which is connected to the beach at low water. Approaching from southeastward, a vessel of the Coast Guard Service anchored in about 7 fathoms, hard sand bottom, with Cape Chiniak bearing 205° true (S ⅛ W mag.), Shakun Rock 86° true (NE by E ½ E mag.), and the settlement rock 346° true (NW ⅝ N mag.). Between Cape Chiniak and Shakun Rock the bottom was found to be uneven, depths 10 to 20 fathoms, mud and hard sand at intervals.

Cape Chiniak, the north point of Hallo Bay, lies 7½ miles northward of Cape Nukshak. There is a high hill near its end.

Hallo Bay has not been examined except near Cape Nukshak. **Ninagiak Island**, in Hallo Bay, has a knob with an estimated height of 200 feet. A rock bare at low water lies approximately ¾ mile eastward of the island.

A reef, about 1¼ miles long east and west, lies in Hallo Bay approximately 1½ miles southeastward of Ninagiak Island and 1¾ miles northward of Cape Nukshak. The reef is bare in places at low water, is covered at high water, and has no kelp.

Cape Nukshak terminates in an island ½ mile long and 134 feet high, with two knolls. The cape is flat and grass covered to the foot of a sharp, prominent peak, but there is a break through the flat part of the cape forming a second island at high water.

Anchorage, sheltered from southerly and westerly winds, may be had about 400 yards off the north side of Cape Nukshak, with the foot of the eastern slope of the peak on the cape bearing 203° true (S mag.), in 22 fathoms, muddy bottom.

From Cape Nukshak to the entrance of Kukak Bay the coast is irregular cliffs, with detached rocks showing some distance off. A reef, partly bare at low water and marked by kelp, extends nearly 1 mile from shore 1½ miles southward of Cape Nukshak.

Kukak Bay is not surveyed, but a fair general idea of it is shown on chart 8851 taken from Russian charts. It is clear in mid-channel and easily entered. There is a stream in the valley on the west side about halfway up the bay, and a flat makes out possibly 300 yards from its mouth. From the valley at the southwest end of the head of the bay a flat makes out to an estimated distance of ½ mile, with deep water close-to. The bay has great depth, there are numerous pinnacle rocks near the steep shores, and the anchorage area is limited.

On the east side of the bay are two islands, Aguligik in its northern part and Aguchik in its southern part. The best anchorage in the bay is apparently in the bight south of Aguchik Island, where the depth is 30 fathoms in the middle, shoaling gradually northeastward toward its head. No dangers were noted in the bight, but it was observed at high water only.

Cape Ugyak lies 8 miles southward of Cape Nukshak and 4 miles northward of Cape Gull. It is the east end of the mountainous peninsula south and east of Kukak Bay. There are some bare rocks close to the cape, and a breaker was seen at low water about in the

position of the sunken rock on the chart, 1¾ miles northwestward of the cape.

Kaflia Bay, between Capes Ugyak and Gull, has a narrow entrance, reported to be bare at low water. In the narrow entrance is an islet. The channel is south of the islet, apparently on either side of a rock bare at low water. The bay has two small basins, with 20 to 35 fathoms in the middle of each, joined by a very narrow channel. It is used by the small boats of the canneries.

Cape Gull is a bold headland, terminating in a cliff 503 feet high. Temporary anchorage can be had in the middle of the entrance to the cove on the south side of the cape, in 9 fathoms, sandy bottom. The south point of the cove is marked by a rocky islet about 15 feet high.

Cape Kuliak rises gradually from a crumbling bluff at the end to high mountains inland.

Between Capes Kuliak and Atushagvik is an open bay nearly 4 miles long, which has not been sounded. A bare rock lies 300 yards off a prominent point on the north shore. A rock bare at low water lies 600 yards southeastward from the point, and another lies ½ mile westward from the point, and ¼ mile from the northern shore.

Cape Atushagvik lies 4¼ miles 225° true (SSW mag.) from Cape Kuliak. It has a low bluff at the water, and rises in a gentle slope to a prominent knoll, 900 feet high, with a decided saddle between it and the higher land farther back. There is a kelp patch nearly ⅜ mile southeastward from the southern end of the cape.

Between Capes Atushagvik and Ilktugitak there are two bays, the southwestern one of which is Amalik Bay. The northeastern bay is 8 miles or more long, 344° true (NW ½ N mag.), and nearly 3 miles wide at the entrance. It is clear of islands, except those off Amalik Bay on the southwest side of the entrance. On the northeast side of the bay, 1½ miles inside Cape Atushagvik, is a low peninsula ⅝ mile long, with a bluff 150 feet high near its end. **Russian Harbor**, the cove on the northwest side of the peninsula, is a good anchorage, 300 to 500 yards from shore, in 10 to 18 fathoms, muddy bottom. Fresh water may be obtained by boat. The entrance of the bay to the anchorage has been sounded, and the only directions necessary are to give Cape Atushagvik and the islands on the southwest side of the entrance a berth of about 1 mile.

Amalik Bay lies on the north side of Cape Ilktugitak, and is separated from the bay northeastward by a high peninsula. No sounding has been done, but there is secure anchorage at its head. Takli Island lies in its mouth. About ⅝ mile northwestward of Takli Island there is an inner chain of islands which extends 1½ miles southwestward from the high peninsula. On the north and west sides of this chain of islands is a basin ⅜ to ½ mile wide. The anchorage is at the north end of the basin. An inlet not surveyed makes inland from the western side of the basin.

The entrance to Amalik Bay on the southwest side of Takli Island is ⅝ mile wide and apparently clear. Thence the channel follows the western shore, and then northward through the basin along the western side of the inner chain of islands.

From the bay northeastward there is a channel along the shore of the high peninsula, passing northward of all the outlying islands, and then between Takli Island and the inner chain of islands.

Takli Island is nearly 2 miles long, its eastern part being low, broken, and rocky. At its extreme western end is a hill 455 feet high, from which there is a sheer cliff to the water. A chain of rocky islands extends 1½ miles eastward from Takli Island. Reefs extend about ½ mile eastward and southward from these islands, and the passage between them and the group of islands 1 mile northward has dangers and should be avoided.

TAKLI ISLAND TO CAPE IKTI.

The coast from Amalik Harbor to Chignik Bay is unsurveyed. The following notes are from the most reliable sources available, but should be used with caution.

The bay east of Katmai Bay is foul.

Katmai Bay is an exposed and rocky roadstead which can only be used in northerly and northwesterly weather. The north part is foul as represented on the chart. A shoal, showing kelp, on which a depth of 6 fathoms was obtained, is reported to lie about 3 miles off the coast and 9 miles eastward of Katmai.

Katmai River, previous to the eruption of Katmai Volcano in 1912, could be navigated by launches at high tide as far as the village. The bar at the entrance is bad and has heavy rips, except at slack water; high-water slack is the time to enter. The inhabitants of the village and of the neighboring villages were moved from their ash-covered homes to Perry, on the peninsula north of Chiachi Island. From last reports, the river was choked with pumice which washes down from the higher slopes faster than the stream can dispose of it. Steam and smoke from Katmai Volcano generally hang over the vicinity, obscuring the higher ground in a murky haze.

The upper part of **Kashvik Bay** is foul; there is no shelter in the outer part.

The southern and open part of **Alinchak Bay** is foul to the head. Although there are many reefs and probably pinnacles around the entrance to the north arm, this arm is reported to offer good anchorage and protection, after it has been entered; but it should not be attempted without local knowledge.

Cold Bay.—Good anchorage is reported in the north end of Cold Bay, the depths being from 14 to 5 fathoms. The anchorage is well sheltered with winds from east, through north, to northwest; but, if the wind is south of east a swell soon makes in. The following **approximate courses** were steered by the steamer *Dora:*

With Cape Karluk 1 mile distant, steer 270° true (WSW mag.) to a position 1½ miles off the outer rocks on the reef extending southward from the north entrance point of Cold Bay; then change to 304° true (W by N mag.), passing Cape Aklek at 4.8 miles from the point of change; Aklek Reef 2 miles off at 5.2 miles; and to abreast of the inner point at 6.1 miles; then steer 276° true (WSW ½ W mag.) for 0.4 mile to anchorage.

Reefs and rocky islets extend several miles southward from the north point at the entrance of Cold Bay. There are bad tide rips off this reef, which is frequently the case along the west side of Shelikof Strait. The shore northward of Cold Bay is generally foul. The bay is open southward and offers poor protection from the frequent heavy seas from that direction.

Small boats, in southeasterly weather, anchor off a small sand beach in a shallow bight just inside the north entrance point and are partly sheltered by the reef.

Cape Aklek, the southwest entrance point, is free from outlying dangers. Just inside this point there is a shingle spit, with high rocky bluffs behind it. In good weather a vessel can anchor off this spit, but the holding ground is bad. A trader lives here, and when the weather permits a surf landing, the mail steamer stops regularly. In winter, the mail goes from this point over the trail to Nushagak. Williwaws are frequent.

Portage Bay is clear of dangers so far as known. On entering, keep about mid-channel. There are houses at the extreme upper end. Anchor in 5 fathoms at low water abreast of a flat promontory with sheer cliffs, a little inside of a small gravel spit that makes off from the east shore. About 1½ miles from the house, 7 fathoms extend for about a mile below the anchorage.

Kialagvik Bay is a large sheet of water protected from the sea by a long chain of islets. The indication on the general chart is inaccurate; there is no conspicuous mountain recognizable as the one shown on the chart. The bay northeastward, leading toward **Becharof** village, is clear of dangers except near the entrance points, where foul ground extends well offshore, and near the village where the water shoals gradually from 3 miles off the beach. The entrance to the inner bay is rather close to the outer islets, with depths of 2 or 3 fathoms over a bar. Within, there are no hidden dangers and the water is mostly deep. A portage to the Ugaguk River begins in a valley near the western end of the inner bay. At the extreme southwestern end rises Mount Alai, from which a large glacier descends on its eastern side, while on the seaward slope two others come down from the same field.

Agripina Bay has been used to some extent by small local craft, and is reported to afford good shelter from all winds. A group of islands lies inside the bay, and a passage is indicated on both sides of them. Anchorages for small craft are indicated at the west end of the largest island, on the south side of the smaller island above it, and in the cove on the north side at the the head of the bay. There is a glacier on the north side of the bay.

Port Wrangell is shown on a sketch on chart 8851; otherwise there is no information available.

No accurate information is at hand about the bays between Port Wrangell and Chignik Bay.

Sutwik Island is low and rolling and its southeast point, Foggy Cape, is low and sandy with dunes upon it. The passage between it and the mainland is rocky and should not be attempted.

CHIGNIK BAY,

in its southern part, is deep and clear so far as known, and the bottom is irregular. In entering or leaving the bay, the passage northward of Nakchamik Island and that southward of Atkulik and Kak Islands are used. From the hills west of Chignik Bay, on a clear day, no rocks were seen, except those within half a mile of the beach.

Hook Bay, on the north side of Chignik Bay, is said to be deep and to furnish good anchorage a short distance westward of the end of

the gravel spit. As observed from the adjacent hills no outlying dangers were seen in this bay.

Nakchamik Island is grass covered and mountainous, the southeastern part being the higher, and the middle, on a northeast and southwest line, being the lower. There is a conical peak just east of the center of the island. Cliffs form the sides in general. On the northeast side is the opening of a broad valley with a sand beach, in front of which, it is reported, anchorage may be had in westerly weather. A reef is reported to extend off the west side of the island for some distance.

Kak Islet is bold and high and generally reddish or grayish in color, with grassy patches on the less steep slopes. The southern bluffs are of marked columnar structure.

Atkulik Island resembles Kak Islet. On the southeast side there is a high haystack rock close-to.

Tuliumnit Point, locally known as Castle Cape, is on the south side at the entrance to Chignik Bay. The point is narrow and the stratification is a conspicuous feature. The strata are of many shades of light-colored rocks varied by bands of black. The summit has been worn into many curious pinnacles and buttresses, which suggest its name.

Castle Bay, immediately west of Tuliumnit Point, is unsurveyed.

West of Castle Bay are four projecting ridges ending in bluffs at the water's edge; the low valleys between them terminate in beaches which inclose lagoons.

Anchorage Bay, chart 8822, lies west of the fourth ridge. This ridge terminates in vertical bluffs about 200 feet high, and rises to a rounded hill which is covered with grass and alders to a height of about 1,000 feet. The ridge west of Anchorage Bay is irregular in form, with bluffs at the water. Off the western point at the entrance is a large, grass-covered rock 82 feet high, connected with the shore at low water, and having a lower rock 100 yards outside it. A reef extends about 200 yards farther out. Westward of the rock the shore is foul for some distance and should not be approached too closely. At the entrance, a shingle spit projects from the eastern shore in a southwesterly direction. The bay is easily recognized by the bluff headland forming the west entrance point with the rock off it, and by the bluffs on the east side, and when nearly abreast of it the smokestacks of the cannery show over the shingle spit. In entering give the outer shore of the shingle spit on the east side a fair berth and do not approach the spit too closely.

In thick weather care should be taken to avoid entering Mud Bay by mistake. By following the south shore of Chignik Bay, which is fairly clear, little difficulty should be experienced under such conditions.

Chignik is on the east side near the head of Anchorage Bay. The wharf is fair, with a good depth of water alongside.

There are two canneries in Anchorage Bay, one in the southeast part belonging to the Northwestern Fisheries Company and the other in the southwest part belonging to the Columbia River Packer's Association. Mail steamers call here regularly and cannery ships are anchored in the bay during the summer months. Chignik post office is at the cannery of the Northwestern Fisheries Company. The best anchorage is in 16 to 18 fathoms, mud bottom, ¼ mile

west-southwestward from the end of the wharf of this cannery. The anchorage closer in under the spit is bad holding ground. Strong winds from northwestward, although infrequent in summer, are sometimes dangerous and cannery ships have been driven ashore by them. Violent williwaws come over the hills which rise steeply from the southeast part of the bay. There are no dangers if the shores be given a berth of over 300 yards.

West of the high ridge on the west side of Anchorage Bay is **Mud Bay**, known also as Doris Bay. Vessels may anchor in the middle of the entrance in 7 to 8 fathoms, but the upper part can only be entered by light-draft boats. A reef extends about 300 yards north-northwestward from the eastern point of entrance.

The extreme southwest corner of Chignik Bay is marked by a high, round-topped, vertical bluff, at the foot of which is the entrance to **Chignik Lagoon**, protected by a long sand spit, with a channel between it and the bluff. There is said to be a least depth of 2 fathoms on the bar and 22 feet at high tide. The channel is moderately wide and inside the entrance offers 3 to 5 fathoms over sandy bottom as far as the cannery. However, the channel is not considered safe, and vessels which supply the cannery anchor in Anchorage Bay or Mud Bay. Only vessels with local knowledge should enter. The Alaska Packer's Association cannery is located on the east side of the lagoon about 2¼ miles inside the entrance.

Beyond the cannery the lagoon is shoal. At high water a 3 or 4 foot channel leads to the head of the lagoon where the river enters. There is water enough for a light-draft vessel to ascend several miles to a brown seam of coal, which is worked for local use. Two or three miles above the coal seam the river issues from a lake, which is 5 miles long, and is connected with another lake, equally large, by a stream about 8 miles long.

The following **approximate courses** and distances were steered by the Steamer *Dora*.

Cold Bay to Chignik.—From the anchorage in Cold Bay steer 85° true (NE by E ½ E mag.) for 1.2 miles to Aklek Reef abeam; then round to 130° true (ESE ½ E mag.) for ½ mile to Aklek Reef abeam a second time; and then change to 152° true (SE ½ E mag.) for 2 miles to Cape Aklek abeam, 2 miles distant. From this position steer 201° true (S ⅛ E mag.) for 9 miles to Cape Unalishagvak abeam, 2 miles distant; then haul to 216° true (S by W ¼ W mag.) for 74.5 miles to Foggy Cape abeam, 3 miles distant, passing 4 miles off Cape Igvak and Poltava Island, 3 miles off Aiugnak Columns and 8 miles off Ugaiushak Island.

From the position off Foggy Cape steer a 253° true (SW ⅝ W mag.) course for 31.5 miles to a point 1 mile off the north end of Nakchamik Island, then change to 260° true (SW by W ¼ W mag.) for 17.5 miles to Chignik Head abeam, ½ mile distant. From the position off Chignik Head, steer 247° true (SW ⅛ W mag.) for 1.9 miles to about a mid-channel position, with the 82-foot rocky islet off the west headland bearing 317° true (NW by W ⅝ W mag.); then change to 213° true (S by W ⅛ W mag.) for 0.7 mile to the southwest end of the shingle spit bearing 112° true (E ⅛ S mag.), distant 900 yards; thence a 169° true (SSE ¾ E mag.) course for 0.8 mile leads to an anchorage in 16 to 18 fathoms, soft, muddy bottom, ¼ mile west-southwestward from the end of the wharf at Chignik.

Chignik to Hook Bay.—From the anchorage ¼ mile west-southwestward from the end of the wharf at Chignik, steer 349° true (NNW ¾ W mag.) for 0.8 mile to the southwest end of the shingle spit bearing 112° true (E ⅛ S. mag.), distant 900 yards; then change to 33° true (N by E ⅛ E mag.) for 0.7 mile to about a mid-channel position with the 82-foot rocky islet off the west headland bearing 317° true (NW by W ⅝ W mag.).

Then a 43° true (NNE mag.) course for 12¼ miles leads to a position off Hook Point; then haul to 26° true (N ½ E mag.) for ¾ mile to a slide abeam; and then change to 15° true (N ½ W mag.) for 1½ miles to a mushroom rock abeam. Round this rock to a 354° true (NNW ⅜ W mag.) course for ½ mile to the mushroom rock abeam a second time; then change to 313° true (WNW mag.) for 1¼ miles to abreast the sand spit; thence a 251° true (SW ½ W mag.) course for ½ mile leads to the anchorage in Hook Bay.

Hook Bay to Nakchamik Island.—From the anchorage in Hook Bay, steer 83° true (NE by E ½ E mag.) for ½ mile to abreast the sandspit; then steer 119° true (E ¾ S mag.) for 1¼ miles to the mushroom rock abeam; then change course to 168° true (SSE ⅞ E mag.) for 2¾ miles to abreast Hook Point. From this position, a 129° true (ESE ⅜ E mag.) course for 10 miles, leads to the northern end of Nakchamik Island, 1 mile distant.

Chankliut Island, as it opens out from Tuliumnit Point, appears as three separate islands tangent to each other. The parts are connected by low necks of land; the eastern and central ones appear generally flat while the western part is conical. The slopes are grassy. There are six pinnacle rocks off the west point of the island, and a small bare rock lies at least ½ mile off this point.

The **channel between Chankliut Island and the mainland** is considered free from dangers. It is commonly used by vessels going west from Chignik. It has not been surveyed. It is reported that on rounding Tuliumnit Point at a distance of about 1 mile, a course 213° true (S by W ⅛ W mag.) leads in mid-channel inside the island. A prominent point, about 12 miles beyond the island, is right ahead on this course.

The land inside of Chankliut Island, from Tuliumnit Point to Cape Ikti, curves inward, instead of outward as shown on the chart.

Between Tuliumnit Point and the easterly head of Cape Ikti there are three anchorages, called by Capt. McMullen, Necessity Cove, Warner or Prospect Bay, and Ross Cove, and the following information is furnished by him:

Necessity Cove, about halfway between Tuliumnit Point and Cape Ikti, affords good anchorage with winds from southwest, through west, to north. It is easily found by white strata which run along the high cliffs.

From the easterly head of Cape Ikti the shore trends north-northwestward about 6 miles to the entrance of **Warner Bay**, which is often called Prospect Bay on account of a copper prospect there. The entrance is about 6 or 7 miles west-southwestward of the south end of Chankliut Island. The bay runs inland about 3 miles to a shingle spit which has plenty of water inside it. This bay is protected from the ocean, and is a safe anchorage in any wind. Passing inside of Chankliut Island until abreast its south end, the steamer *Dora*

steered the following approximate courses and distances to the anchorage in Warner Bay:

From the south end of Chankliut Island abeam, steer 234° true (SW by S mag.) for 5 miles to a white cape abeam; then steer 257° true (SW by W mag.) for 2 miles to Prospect Head abeam. From this position, steer 293° true (W ¼ N mag.) for 1½ miles to breaker rock abeam; then round to 323° true (NW by W ⅛ W mag.) for 0.3 mile to the breaker rock abeam a second time; then change to 4° true (N by W ½ W mag.) for 2½ miles to the sandspit abeam, and thence steer various courses for 0.7 mile to an anchorage.

Leaving Warner Bay bound westward.—From the sandspit abeam, steer 186° true (S by E ¼ E mag.) for 2½ miles to breaker rock abeam; then change to 168° true (SSE ⅞ E mag.) for 5.2 miles; thence a 205° true (S ⅜ W mag.) course for 2.3 miles leads to a position about 1 mile off the headland eastward of Cape Ikti, locally known as Seal Cape.

Ross Cove is a left arm of Warner Bay. It can be used only by small craft, and can not be seen until well up to the high bluffs. There is a shingle spit about ½ mile long; the entrance at the end of this spit is 200 feet wide and a right-angle turn has to be made to enter the cove. There is about 12 fathoms inside.

CAPE IKTI TO KUPREANOF POINT.

Kuiukta Bay.—The entrance to Kuiukta Bay is 4.5 miles wide, and the bay extends 14 miles inland in a northwesterly, changing to northerly, direction. At its head is a valley with an easy portage leading to Chignik. The bay has an average width of 1.4 miles, and has several smaller bays and bights opening from it. The shores are extremely precipitous, and consist of bare cliffs of great height, strongly colored in shades of gray, red, and black. The rocks appear to be well mineralized, and there is a prominent outcrop of iron ore, resembling a lava flow, on the eastern side 4.7 miles northwestward from Cape Ikti. The water is deep and it is difficult to find anchorage except close to shore in the heads of the smaller bays. There is a small, low islet, on the east side, at the elbow of the bay 9 miles inside Cape Ikti, and a higher sugarloaf islet near the northern end. About 1 mile above the sugarloaf the water shoals.

Cape Ikti lies on the eastern side of the entrance of Kuiukta Bay, and the unnamed point near Mitrofania village lies on the west side; both are about 1,500 feet high, and present an extremely rugged skyline of rocky spires, towers, and buttresses.

Foot Bay and **Windy Bay** are the only 2 which have names among the 12 which indent the shores of Kuiukta Bay. All of them are swept by strong squalls in bad weather. The anchorage in Foot Bay is in 20 fathoms, with scant swinging room toward the beach.

Mitrofania village is a small settlement of half-breeds; it can not be seen from seaward from any direction, except the flagpole standing on a small hill. It should be approached from westward, and an excellent anchorage is found in the small inlet leading toward the village flagpole. Anchor in 19 fathoms, sticky bottom, with the flagpole bearing 76° true (NE by E mag.), about 0.5 mile distant; there is good shelter here from all winds. Small craft can find secure shel-

ter in the lagoon behind the village, the entrance to which has a depth of about 4 feet at low water. A narrow spit separates the lagoon from an arm of Kuiukta Bay. About 2.5 miles northward from Mitrofania village there is a portage across the peninsula to Kuiukta Bay.

Mitrofania Bay includes all the sheet of water north of Mitrofania Island; in its northern part are two unnamed bays near Mitrofania village, and farther westward is **Ivan Bay.** These bays are surrounded by precipices and sharp peaks; but westward of Ivan Bay there is a flat river valley, and the coast stretches south-southwestward in a straight line forming Long Beach. In Ivan Bay and abreast of Long Beach the water is deep and there is no anchorage.

Long Beach is a steep black sand beach, which extends in a crescent form about 3 miles northeast and southwest. It is flanked on the northern end by a vertical cliff 600 to 800 feet high, made conspicuous by many strata of different colored rocks, and on its southern extremity by a precipitous mountain covered with a dense growth of alder bushes. An isolated rock lies near the base of the mountain about 300 yards back from the beach, nearly rectangular in form, the sides being vertical, about 100 feet broad by 60 feet in height, and the top slightly rounded and covered with grass, ferns, and small bushes. Seen from a distance it has the appearance of a huge, native sod house, with the roof overgrown with grass. An extensive valley lies back of the beach in which are several ponds of fresh or brackish water.

Temporary **anchorage** with offshore winds can be had near the southwest extremity of Long Beach, on the west side of Ivan Bay, but a heavy swell rolls in with southerly and southeasterly winds. Give due attention to the lead as the bank is steep.

Mitrofania Island is 6.5 miles long and 4.5 miles wide, and consists of many sharp peaks of nearly the same height; the highest is about 2,000 feet. There is a secure harbor, except for northwesterly winds, in the bight on the west side of the north point of Mitrofania Island. **Spitz Island** and reef lie 1 to 2 miles southward of the southwest point; it is a small sugarloaf islet about 1,075 feet high, with a reef extending 0.6 miles southward from it.

Little Brother and **Big Brother Islands** lie in Mitrofania Bay, nearer to Mitrofania Island than the mainland; they are similar in size and shape, about 0.4 mile in extent and 390 feet high, with a flat profile. There are rocks awash and broken ground between them and Mitrofania Island, but toward the mainland the channel appears to be clear. The *Dora* has used the passage between the islands and the north end of Mitrofania, passing close to the latter on a 251° true (SW ⅝ W mag.) course.

Veniaminof Volcano sends out a spur in this direction, which is flanked both east and west by extensive plains, and this spur reaches the sea at **Coal Cape.** The cape is about 1,200 feet high, but soon reaches an elevation of 2,100 feet; its skyline is extremely broken and serrated.

Chiachi Island (chart 8881) is 3 miles in extent, and lies 1 mile from the nearest point of the coast; it has several rugged peaks, the highest of which is about 1,675 feet. The anchorage shown on the chart is not recommended. Four islands lie near its northeast shore; the

southeasternmost is unnamed; **Pinusuk Island** is a long ridge with a reef and a tower rock eastward of it; **Shapka Island** is a sugarloaf 700 feet high; and **Petrel Island** is a small flat rock mass. In this locality the navigator should follow the mainland and leave all islands to seaward.

Perry, an Indian village, was established to provide for the people who were driven away from the vicinity of Katmai Volcano by the eruption of 1912. It consists of a number of wooden houses and a small store standing on the flat beach 4.5 miles westward of Coal Cape. The landing is exposed, especially in southeasterly weather.

Three Star Point is formed by a low rocky outcrop in the flat plain; it is 1.6 miles southwestward of Perry and 4 miles from the foot of Coal Cape mountain range. Westward of it there is a long beach. **Coal Point** marks the end of this beach, and the eastern side of another mountain range. **Humpback Bay** lies west of Coal Point between Egg Island and the mainland; there is a portage from Humpback Bay to Ivanof Bay.

Egg Island is 1.2 miles long by 0.5 mile wide, and consists of rounded hills, the highest of which is 478 feet. A reef extends from Egg Island almost half way across the channel toward Paul Island.

Alexander Point lies on the west side of the channel westward of Paul Island. It is the extremity of a range of hills and is about 1,500 feet high.

Paul Island is a crescent-shaped range of hills, reaching an elevation of 1,568 feet in the northern portion of the island. **Jacob Island** is shaped like a leg of mutton, and is 1,666 feet high near the northern end; from the summit a sharp ridge extends southward to **Noon Point**, meeting the sea in an overhanging precipice.

Kupreanof Harbor (chart 8881) is inclosed by Paul and Jacob Islands; it is circular in shape, 1.1 miles across, and free from dangers. It is sheltered from the sea and from all winds. The western entrance is 0.7 mile wide and free from danger; vessels have used the eastern entrance also; it is 0.4 mile wide. This harbor is the most accessible safe harbor in a wide region. For directions, see page 149. There is a cattle ranch here. Both islands were formerly stocked with foxes, which have now almost disappeared. There are goats on Jacob Island.

Ivanof Bay lies between Alexander Point and Kupreanof Peninsula; it is 1.5 to 1.1 miles wide and 7 miles long. There is an island in the middle of it 0.7 mile long, 0.2 mile wide and 350 feet high. Westward of the island the channel appears to be clear, but eastward of it there is a low-tide rock 0.3 mile off the island and another rock 0.2 mile off the east shore; between the rocks a careful midchannel course leads through deep water. Ivanof Bay is a safe harbor in bad weather, and one may anchor anywhere above the island, avoiding the mud flats in the northeastern part and those near the lagoon.

Westward of the north end of Ivanof Bay is a large lagoon, and **Granville Portage** leads across flat land to Stepovak Bay. The portage is an important one because it is easy, and because it avoids the danger of rounding Kupreanof Point.

KUPREANOF POINT TO CAPE ALIAKSIN.

Kupreanof Point is a cluster of confused ridges and pinnacle peaks 1,600 feet high; its southern face extends in an east and west line for 4.8 miles. The ridge of the peninsula presents a series of peaks all the way between it and Granville Portage. On the western side is **Boulder Bay**, which offers good anchorage; and **Fox Bay**, which is said to be an excellent harbor for light craft. Farther north is **Island Bay**, and northward of this is a low flat islet near the coast. The shores all around Kupreanof Peninsula appear to be reasonably clear at a short distance offshore; the reef which appears on chart 8802 off Kupreanof Point consists of a few broken rocks in the surf at the foot of the cliffs.

Stepovak Bay is inclosed on the east by Kupreanof Peninsula. Several widely spaced lines of soundings were run in the bay, which would indicate that the east central part of the bay is safe; and that the western part and the northwest shore from Bales Landing to Cape Swedania are more broken and may develop dangerous shoals.

Gull Rock lies 0.6 mile off the northern shore of the bay, and is a bare ledge about 40 feet high. From Gull Rock to Granville Portage there is flat alluvial land, through which flows **Big River**, discharging drainage from this part of the snow fields and glaciers of the Veniaminof range. Westward and southwestward from Gull Rock the coast is backed by a high snowy range of peaks and spires cut by narrow glacier-filled ravines. A spur of this range forms Cape Swedania, and the main range is cut by the portage leading from Balboa Bay to Port Moller.

Ramsey Bay is 3.5 miles west-southwestward of Gull Rock, and is reported to be filled with low-tide rocks, upon which one cannery ship has been lost. **Bales Landing** is close to Ramsey Bay, toward Gull Rock, and 2.6 miles westward of Gull Rock. There is anchorage off the house which stands here, on the eastern side of the valley; the locality is called **Louies Corner.** The house is occupied by the owner of a sulphur mine in the valley. Two small glaciers end about 4 miles up the valley from the beach, with ice-falls down the cliffs upon the flat land.

When **approaching Bales Landing** anchorage, care should be taken to avoid a sand spit shoal which runs out about ½ mile a little westward of the flagpole. It is best to keep **Lookout Hill** (which is very prominent) a little on the port bow until close up to the land, then follow the shore and anchor in 7 fathoms about ¼ mile eastward of the flagpole.

The coast is foul from Ramsey Bay around the point as far as **Grub Gulch**; there are several low-tide rocks and some kelp. A vessel should keep 1 mile off the beach. The point westward of Grub Gulch is a sharp red mountain about 2,000 feet high; the soundings indicate a reef 1.5 miles long extending on the line of the ridge from the end of this point. There are 2 low grassy islets and some rocks in the entrance of Grub Gulch; but there may be a channel leading in westward of these.

Clark Bay is a large open bight backed by two valleys; the southern part is called Little Norway.

Orzinski Bay is marked on the northeast side by **Waterfall Point**; it is 2 miles long and 1 mile wide. The waterfall on Waterfall Point

is on the extremity of the point, in a most unnatural position, and shows on the tangent in profile; the peak back of it is 1,895 feet high.

Elephant Point is a sharp ridge 655 feet high, with inclined strata breaking off in sheer cliffs on the southwest face; off the end of the point are reefs 0.4 mile long eastward and southeastward, partly dry at low water. A vessel should keep more than a mile off it.

There is a reef almost in the middle of Orzinski Bay, slightly nearer to the north shore, abreast of the peak on Waterfall Point. There is a fishing station in the southwestern corner of the bay, called **Orzenoy**, standing on the shore of the stream which drains the lagoon up the valley. The warehouse may be used as a leading mark for entering; steer for it bearing 295° true (W ½ N mag.), in range with a notch in the mountains behind it and a rocky peak appearing through the notch on this bearing; beware of the reef off Elephant Point and favor Waterfall Point if in doubt. When abreast of the peak on Waterfall Point, beware of the reef on that side, and favor the other shore if in doubt; when past this reef, steer 332° true (NW ¼ W mag.) for the right-hand or northern part of the gravel beach at the head of the bay and anchor in deep water off the low rock cliffs adjoining the beach at its northeastern end, at the opposite corner from the fishing station.

American Bay or **Mobile Bay** is a narrow fiord between steep rocky mountain walls. The wind squalls are extremely severe in bad weather. The entrance is a hole in the wall, ½ mile wide, between two gravel spits. Parts of the inner bay are almost landlocked; there is a small rocky shelf projecting under water for a short distance at the head of the bay. It is necessary to anchor near the middle of the inner bay; otherwise there is no swinging room.

Between American Bay and Guillemot Island are **Windbound Bay**, **Chichagof Bay** (commonly called Chicago Bay), **Dorenoi Bay**, and **San Diego Bay**. These were not thoroughly reconnoitered.

Guillemot Island is locally called **San Diego Island**. It is crescent shaped, about 400 feet high, fairly level on top, and surrounded by almost impassable cliffs. Between it and the mainland there is a chain of oddly shaped rocks, islets, and reefs. There appears to be a partly protected anchorage in the bight on the southwest side of the island, inside the crescent. From here to Cape Swedania the shore has a narrow fringing line of rocks, but appears safe at a reasonable distance.

Lumber Bay, or Rough Beach as it is called locally, lies on the eastern face of Cape Swedania, 2 miles northeastward of its south end, and consists of a shallow bight at the entrance of a valley; the beach is a dike of cobbles thrown up by the sea, and is capped by a great windrow of driftwood.

Cape Swedania is the seaward end of a ridge 1,200 feet high; there are rugged cliffs at the extremity, and on the southwestern side there is a gravel spit at the foot of the cliffs. The profile and end slope of Cape Swedania are striking and unusual, resembling in magnified outline the end of an artificial earthwork or bunker, back of which the mountain rises steeply. There are strong williwaws in the lee of it.

Balboa Bay offers good shelter on the eastern side about 5 miles from Cape Swedania; there is a small bight here with a low gravel point south of it at the mouth of a large ravine containing a stream.

The mid-channel into the north arm is deep. When the coal mine at Herendeen Bay was in operation supplies were landed here and carried across the trail by pack train, a distance of about 15 miles. The highest point on the trail, less than 600 feet, is near the south side of the peninsula.

Albatross Anchorage (chart 8851) is a secure harbor near the head of the north arm of Balboa Bay. The best anchorage is in mid-channel abreast of **Ballast Island** (close to east shore) and has a clear width of 0.4 mile, with depths of 5 to 8 fathoms. A reef extends well off from **Reef Point**, on the east side 0.6 mile southward of Ballast Island. Small craft may anchor in the bight on the west side opposite Ballast Island and secure better protection from the sea by keeping well over on the southern side to avoid a ledge which uncovers at half tide and extends 300 yards southeastward from Bassett Island. The depths are 8 to 12 feet.

Temporary anchorage for small vessels may be had in **Left Hand Bay** on the west side of Balboa Bay. A shoal extends 200 or 300 yards off shore, then drops rather steeply. Low, marshy ground, known as **Kagayan Flats**, leads from the head of the bay to Beaver Bay.

Cape Aliaksin has no distinctive form; it is of a rounded outline and a low rounded profile; there is low land for some distance from the shore all round. The summit is broad and flat, and about 1,700 feet high. There is shoal water near shore all round, and a rock awash at high water about ¼ mile off the southwest side. The eastern part of Cape Aliaksin, rounding into Balboa Bay and Left Hand Bay, is called **Cape Kagayan.** Cape Aliaksin is distinguished with difficulty from westward, but it comes out clearly from eastward.

SHUMAGIN ISLANDS.

The surveys include Unga Island, except the west coast; the coasts of Nagai Island from Wedge Cape to Eagle Harbor on the west side and from Wedge Cape to the bight south of East Bight on the east side; the islands between Unga and Nagai Islands; the four islands in East Nagai Strait; and the west coast of Big Koniuji Island from abreast of Peninsula Island to abreast of Bendel Island. The available information for the other islands is similar in character to other unsurveyed areas.

This group, lying southwestward of the Semidi Islands and separated from the mainland by Unga Strait, consists of fifteen islands and many islets and rocks extending in an east-southeasterly direction. In general, the islands are bold and mountainous and the coasts are greatly broken by inlets that afford good anchorages. The shores are rock-bound close-to.

There are fishing stations and camps scattered throughout the group, and good fishing banks off the islands. Fox and cattle raising are carried on to some extent.

SIMEONOF ISLAND (CHART 8881),

the most easterly of the group, is about 4 miles long and 3½ miles wide. It is composed of two clusters of hills, the southeastern and higher ones being about 1,600 feet high. These hills are separated by a low plateau which is nearly cut in two by a very irregularly shaped harbor.

The coast of the island is fringed with reefs and shoals. Those on the south and southwest sides are variously reported to extend from 3 to 7 miles offshore; those on the east side, 3 miles; and those off the other shores, ½ mile.

A rock on which the sea breaks at low water has been reported half way between Simeonof and Chernabura Islands.

Simeonof Harbor is on the western side of the island. A reef extends about ½ mile westward from the north point of the entrance to the harbor. Off the south point of the entrance is a low, flat, rocky island fringed with reefs. The harbor is protected from all winds; the entrance is tortuous, with reefs on either side; the shores are rocky and the water very shoal. The inner anchorage is in 2½ fathoms, with not over 2 fathoms at the lowest tide; the bottom is smooth gravel. Anchorage, exposed to westerly winds, may be had in the outer part of the harbor, in about 4 fathoms, about ½ mile inside the entrance.

Twelve Fathom Strait separates Simeonof and Little Koniuji Islands. The strait is about 2¼ miles wide, with depths of 12 to 16 fathoms. With the exception of a few kelp patches on the Simeonof side, no dangers are known.

LITTLE KONIUJI ISLAND

is very irregular in shape, consisting of three parts, 1,200 to 1,500 feet high, connected by raised sand beaches. The southern end terminates in a high, rocky, pointed cape, with a reef, marked by a breaker, extending about ¼ mile southwestward from it. The eastern coast is indented by two coves, and there is a large harbor on the western side.

Sandy Cove (chart 8851) is on the eastern side of Little Koniuji Island. It is about 1 mile wide at the entrance, and 1½ miles long. There are prominent granite cliffs on its western shore. The cove affords good anchorage in its southerly bight in about 10 fathoms, sheltered from all but southeasterly weather.

Atkins Island is about 1½ miles long and about ⅝ mile wide, and is connected to the northeast headland of Little Koniuji Island by a shoal. The island rises to a height of 800 feet at its southeastern end. Anchorage is reported southward of the island.

Northwest Harbor (chart 8881), a bight in the northern side of Little Koniuji Island, southward of Herendeen Island, may be entered from either side. It affords fair anchorage and protection from all but northeast winds in 5 to 10 fathoms. The harbor is about ½ mile wide. There is an abandoned fishing station here.

Herendeen Island is triangular shaped, about ⅞ mile long and ½ mile wide. There is an islet off the western end.

Northeast Harbor (chart 8881), the large bay in the western side of Little Koniuji Island, has two bights and is approximately 4½ miles long. The east bight of the harbor is somewhat open to westerly winds and the holding ground is rocky and poor. The extreme southeast end of the harbor is more protected and is a favorite refuge for fishermen, though the bottom, being alternately patches of rock and sand, is not good holding ground. There is a small, well protected boat harbor here, at the head of which are several houses belonging to a fox farm.

CHERNABURA ISLAND

lies about 8 miles southwestward of Simeonof Island, and is the most southerly of the group. The entire island is high and mountainous and there are few breaks in its profile, the highest part being at the east end. A rocky islet, apparently connected with the main island by a bar, lies off its northern end. On the east side are three small bays, the middle one of which is reported to afford anchorage in westerly winds.

BIRD ISLAND

lies about 4 miles westward of Chernabura and is more irregular than that island, but several of its peaks are nearly as high. Passing well southward of Bird Island it appears as four principal peaks connected by low valleys. Almost its entire southeast side is a series of cliffs. A rock above water lies a short distance off its southern end.

An anchorage is reported in the bight on the east side of Bird Island, just inside of Point Welcome, in 5 to 12 fathoms. The wreck of a schooner is at the head of the bight. Temporary anchorage, exposed to all but winds from the southeast quadrant, may be had in the bight in the northwestern side of the island in about 12 fathoms, sand bottom, southwestward of the reef making about 1 mile in a northwesterly direction off the northwest point of the island. There are rocks about ½ mile offshore in a westerly direction from the southerly point of this bight and a shoal about 1 mile in a northwesterly direction off the southwest point of the island. Sunken rocks are found lying about ½ mile off the northern shore of the large bight on the eastern side of the island.

Otter Strait, between Bird Island and Chernabura, is said to have depths between 20 and 35 fathoms, sandy bottom.

BIG KONIUJI ISLAND

lies west-northwestward of Little Koniuji Island, from which it is separated by Koniuji Strait. It is about 11 miles in length and about 6 miles in width at its widest or southern end. It is rugged and very mountainous, with a well-defined central ridge and spurs projecting toward the points. The coast is broken by many inlets and the points are rockbound close inshore. The highest peaks are frequently mist covered. Its northern point is comparatively low and its southwestern end terminates in a long narrow point with a high connecting ridge, which resembles an island from some points of view; it has been called Kungiugan.

Flying Eagle Harbor, on the east side of the island, about 5½ miles southward of Cape Thompson, offers well protected anchorage for small vessels, especially in southerly gales, in 7 to 10 fathoms.

Hall Island, about ⅞ mile long and ⅜ mile wide, lies about 1 mile off the eastern shore. There are two rocks above water close to the southeast face of the east end of the island, and a reef extends about ¼ mile southwestward from the southwest point.

Murre Rocks are a group of three islets about ⅝ mile northwestward from Hall Island. A rocky ledge extends about ¼ mile southwestward from the southern islet.

Yukon Harbor (chart 8881) lies southwestward of Hall Island. It has a rocky ledge covered with kelp lying close around the eastern

entrance point, and rocks close to the western point. Anchorage, protected from westerly weather, may be had in the center of the harbor, in about 7 fathoms, but the bottom is poor holding ground.

There is a bay eastward of the southwestern point of Big Koniuji Island, but the depth is reported to be too great to afford anchorage. East of the bay is another one, larger and wider, in which vessels have anchored in 16 fathoms, hard bottom, with protection from northerly and westerly winds. The holding ground is poor. East of this is a high headland on Koniuji Strait. A 3-fathom shoal extends from the south end of the island.

There are four prominent bights on the west side of the island. They are open and easy of access and their shores are clear, except close-to.

Anchorage in 24 to 26 fathoms may be had near the head of the bight 146° true (SE ¾ E mag.) from Peninsula Island. In approaching the anchorage it is necessary to keep northward of mid-channel to avoid a shoal extending 300 yards off the south shore about ½ mile from the head of the bight.

The other bights do not offer anchorage on account of the great depth of water. **Anchorage** for very small craft may be found in any of these bights, close in shore, and in the numerous indentations and small coves. The winds draw through the divides into the bights and the williwaws are very strong.

Koniuji Strait is about 1½ miles wide. Soundings of 16 to 28 fathoms are reported.

Castle Rock, lying about 1½ miles northward of the north point of Big Koniuji Island, is rugged and serrated, and its highest peak has an elevation of 825 feet. It makes an excellent landmark. A 3-fathom shoal extends about ¾ mile off its southern end.

The bottom between Big Koniuji and Castle Rock is said to be even, averaging 28 fathoms.

EAST NAGAI STRAIT

separates Nagai and Big Koniuji Islands and has an average width of about 6 miles.

Peninsula, Spectacle, Bendel, and **Turner Islands** lie in a general north-northeasterly and south-southwesterly direction in this passage, and the waters between this chain of islands and Nagai on one side and Big Koniuji on the other are deep and clear and mid-channel courses may be safely steered.

Peninsula Island, the most northerly of this group, has a length of 1½ miles and a width of ¾ mile. It has a central peak 1,190 feet high. The shore is rugged, steep, and rockbound. A long bowlder spit extends off the southeast end. The northeast end should not be approached closer than ¼ mile and the southeast end not closer than ½ mile. Exposed anchorage may be found on the tail of the shoal extending off the southeast point, in 7 to 12 fathoms, a short ½ mile from the narrow point.

Spectacle Island, lying 3¼ miles southward of Peninsula Island, is 2½ miles long and 1½ miles wide at its southern part. It is rockbound and has steep cliffs on the north, east, and south sides. The northern part is distinguished by two peaks about 900 feet high and the southern part reaches an elevation of 1,240 feet. In general, the island may be approached within ⅛ mile.

There are anchorages, under favorable conditions, for small craft in the large bight on the east side of Spectacle Island in 6 to 9 fathoms, in the bight on the west side in 4 to 5 fathoms, and in the small cove in the south side in 3 fathoms. The bights on the eastern and western sides are open and easy of access. The entrance to the small cove on the southern side is about 70 yards across with foul ground on either side for a distance of about ⅛ mile inside the entrance.

The passage between Peninsula and Spectacle Islands is about 3½ miles wide and is deep and free from dangers.

Bendel Island lies in a southwesterly direction from Spectacle Island and is separated from it by a passage ⅝ mile wide. It is about 2 miles in diameter and 1,250 feet high. The eastern end terminates in a narrow neck. There are high bluffs on the southern side and sloping valleys on the others. The coast line is rocky, with kelp, and the depths around the island are irregular.

A flat extends off the southwest side for a distance of about 1 mile with depths of 5 to 10 fathoms and with several shoaler spots. Depths of 7 to 8 fathoms are also found off the northwest and southeast sides. Exposed anchorages for small boats may be found in the bights and on the flats.

The passage between Spectacle and Bendel Islands is ⅝ mile wide and a mid-channel course leads through 21 to 11 fathoms.

Turner Island is separated from Bendel Island by a passage from ¾ to 1½ miles wide. It is 2¾ miles long and about ⅞ mile wide, with a greatest elevation of 1,180 feet. Its shore is rock-bound and the southeast coast is very foul for a distance of about ½ mile offshore. There is a low flat on the northwest end with a 400-foot knoll on the point. The bluffs on the north, southeast, and south sides vary in height from 400 to 800 feet.

The passage between Bendel and Turner Islands is deep at both entrances and shoals gradually to 4 fathoms, in its narrowest part, about mid-channel off the southwest point of Bendel Island. Dense kelp grows on this shoal and small craft find difficulty in passing through. The use of this passage is not recommended for large vessels.

The Twins consist of three small islands, the highest of which has an elevation of about 200 feet. Their sides are precipitous and bare. As no breakers were seen about them in heavy weather, it is presumed there are no outlying dangers.

Near Island is about 2 miles long and 600 feet high, with precipitous, rocky sides. The island is easily recognized by a regular serration, which cuts its crest into five little peaks. There are rocks close to the shore.

NAGAI ISLAND

is approximately 29 miles long and 9 miles wide. Its coast is irregular and indented by numerous inlets, several of which extend nearly through the island and have low narrow isthmuses at the head. The island is mountainous and its shores rock-bound; near the center it reaches an elevation of 1,837 feet in a group of confused ridges.

Wedge Cape, the northern end of the island, is a narrow headland with a rounded, sloping hill 749 feet high. The north end of the cape terminates in a double point, with elevations of 262 and 316 feet and a rocky bluff 150 feet high between. Its shores are rocky and for-

bidding, but may be approached within ¼ mile with depths of 14 to 25 fathoms; closer in a vessel would be in danger. In general, however, a vessel should keep 1 mile offshore.

Mountain Cape, the southerly end of the island, is narrow and about 500 feet in height. There are rocks surrounding the point at a distance of about ½ mile and a sunken rock about 1 mile offshore in a south-southwesterly direction.

Pirate Shake is a local name for the low neck, about 65 yards wide, of Nagai Island, 4 miles southward of Wedge Cape. The cove on the east side of the neck is a good anchorage for vessels, but is exposed to winds from about east-northeast to east-southeast. The outer points at the entrance are surrounded by reefs, and a reef, bare about 8 feet in places at low water, lies in the middle of the entrance. The better entrance is northward of the reef, heading for an islet on the north side of the cove on a 286° true (W ¼ S mag.) course. Pass 300 to 500 yards southward of the islet, and anchor in the middle of the cove west-southwestward of the islet, in about 8 to 9 fathoms, bottom soft in places. Anchorage can also be selected in the entrance of the cove just eastward of the islet, in 7 to 8 fathoms, bottom generally rocky, taking care, however, to avoid the reef which extends about ⅜ mile from the northeasterly shore of the cove. The flat islet (40 feet high) on the north side of the cove, and a wreck just inside the outer point on the south side of the cove are good marks for the entrance.

Northeast Bight, on the east side of Nagai Island, about 6 miles southward of Wedge Cape, is about 4 miles long and 1¼ miles wide. It is open, deep, and free from dangers except close to shore. The main body of the bight is too deep for anchorage, but a vessel may anchor in the two coves at the head in about 20 fathoms.

Mist Harbor is a landlocked basin about 1 mile long and ⅜ mile wide, lying on the east side of Nagai Island, about 12 miles southward of Wedge Cape, and 314° true (NW by W ⅞ W mag.) from the northeast end of Bendel Island. The depths in the middle of the basin are 27 to 35 fathoms, but small craft can find a secure anchorage in the cove on the south side of the west end of the harbor, in 6 to 7 fathoms. The south side of the harbor is formed by a long spit; the entrance is around the west end of the spit and is about 250 yards wide, and necessitates a sharp turn in entering. A mid-channel course should be followed through the entrance, and in entering the cove at the west end of the harbor to the anchorage. A flat fills the easterly end of the harbor, and otherwise there are no dangers away from the shores.

A fishing camp is usually located on the cove at the west end of Mist Harbor, and small temporary wharves may be found. Water may be had from small streams on the northeasterly side of the harbor. Strong williwaws draw down from the high mountains at times. A low neck of land, about 150 yards wide, separates the west end of the harbor from the head of Northeast Bight.

East Bight, on the east coast about 3 miles southward of the entrance to Mist Harbor, is about 3¼ miles long and 2 miles wide. It is deep, open southeastward, and the shores are clear except close-to. Anchorage for moderate-sized vessels may be found on the shelf on the northeast side in 15 to 20 fathoms, about 1 mile inside the north entrance point and about ⅜ mile offshore.

The two west arms do not afford good anchorage on account of the depth, about 29 fathoms. There is a 7-fathom spot, surrounded by deep water, in the northern of the two arms, lying 650 yards off the west shore and about ⅞ mile from the head of the arm.

The entrance to the south arm is restricted to about 450 yards by a shoal extending about 650 yards in an easterly, and 900 yards in a northerly direction off its south entrance point. **In entering** favor the north shore at a distance of ⅛ to ¼ mile. Small boats may find protected anchorage behind the hook at the south entrance point, in 9 to 15 fathoms. After passing well through the entrance to the arm, head 180° true (S by E ¾ E mag.) to pass about 100 yards westward of the west end of the hook spit. When abreast of the end of the hook, round into the cove and select anchorage about in its center.

A bight about 3 miles southwestward of East Bight, locally known as **Pete Larssen Bay**, affords good anchorage in 4 to 10 fathoms, sandy bottom. The bight is open and easy of access but is exposed to easterly winds. The western shore is low and is distinguished by white sand dunes. There is a bold headland about 100 feet high projecting from the south side.

There are several open bights on the east coast of the island between Pete Larssen Bay and Mountain Cape.

John Island, in the large bay in the southwest part of Nagai Island, is 300 or 400 feet high.

South of John Island, Nagai Island consists of two clusters of rocky hills, about 1,000 feet high, united by low isthmuses.

The southerly isthmus is called **Saddlers Mistake**, due to a vessel attempting at night to pass through between the adjacent high parts of the island.

Falmouth Harbor (chart 8881), on the west coast of Nagai Island, about 6 miles northward of John Island, affords a secure, though limited, anchorage for a small vessel in the basin behind the spit at its head, in 7 to 8 fathoms, sandy bottom. The entrance to the basin is not over 300 yards wide, has a depth of 6 fathoms, and contains no known dangers. The basin is ½ mile wide, and its north side is a broad sand flat which drops suddenly to 4 fathoms.

A reef extends ¼ mile southwestward from the south head of Falmouth Harbor; and a rock, bare at low water and marked by a breaker and kelp, lies ¾ mile from that head in the same direction.

The south shore of Falmouth Harbor is low at the water's edge but slopes rather steeply. The northern headland rises some 500 feet in a perpendicular cliff. The shore is rocky and bold. A rock, 5 feet above water, stands ¼ mile from shore and 1¼ miles northwestward from this headland. Halfway up the bay on the south side is a low point, with a rock close-to, known as **Cape Horn.**

Wooly Head, between Falmouth and Eagle Harbors, is a promontory 1,200 feet high; there are rocks 0.2 mile from shore all around its face, some of them awash and others forming towers and pinnacles 50 feet high. A vessel may pass ⅜ mile off in 20 fathoms. Violent williwaws are frequent here.

Eagle Harbor (chart 8881), northward of Wooly Head, is about 4½ miles long in a southeasterly direction and 1¼ to ½ mile wide, and has a depth of 15 to 20 fathoms, with no outlying dangers until approaching the spits which lie 1½ miles from the head of the harbor.

In passing between the spits, favor the one on the southwest shore. There is good anchorage anywhere in the head of the harbor above the spits in 14 to 18 fathoms, soft bottom. Small craft can anchor in the lagoon behind the north spit in depths of 5 to 7 fathoms.

There is a fishing station, with a large warehouse and a boat wharf, on the southern side of Eagle Harbor, 1.3 miles inside the entrance, and a small abandoned fish station and boat wharf on the north shore 1.8 miles inside the entrance.

Sanborn Harbor (chart 8891) lies about 3½ miles northward of Eagle Harbor. The pinnacle rock 103 feet high off East Head, the northern entrance point, and the two waterfalls on the west face of the south entrance point, are conspicuous landmarks.

The harbor is 5 miles long and has good anchorage at its head. To secure good shelter in Sanborn Harbor, a vessel should pass between Macks Head and Granite Point, and then anchor as desired, avoiding only the upper half of the northeast arm, which is shoal. There are no outlying dangers anywhere in Sanborn Harbor.

There is a fishing station in a small exposed bay on the north side of Sanborn Harbor, 2¼ miles southeastward of East Head; it has a warehouse and a boat wharf dry at low water.

Catons Cove lies on the north side of Sanborn Harbor, 3½ miles southeastward of **East Head**; there is shelter, in the Kitchen, for light craft, back of the sand spit. The channel, close to the spit until through the narrowest part of the entrance, has a least width of 100 feet and a least depth of 10 feet.

Porpoise Harbor, about 3 miles northward of Sanborn Harbor, affords no useful anchorage on account of great depth.

The bight about 2½ miles northward of Porpoise Harbor has temporary anchorage in 8 to 15 fathoms, giving the shore a berth of over 300 yards. **Porpoise Rocks** are a small cluster 10 feet high, with deep water close-to, lying 0.8 mile from the north shore in the approach to the bay.

The narrow bight west of **Pirate Shake** affords anchorage for small craft about ¼ mile inside the entrance and about on the middle line of the cove, in 4 to 6 fathoms, rocky bottom. The bight is exposed to westerly winds and its eastern half is foul and shoal to the head.

WEST NAGAI STRAIT,

between Nagai and Andronica Islands, is 3.3 miles wide at its narrowest point between Porpoise Rocks and the Haystacks, with depths from 25 to 45 fathoms and no outlying dangers. A vessel should pass eastward and southward of the Haystacks and on these sides may approach as close as 0.3 mile in 25 fathoms.

The currents in West Nagai Strait set with the wind, and reach a velocity of 1½ to 2 knots in strong winds. Under ordinary conditions the prevailing set of the current is said to be southwestward in this vicinity.

The Haystacks are a formidable appearing group of four islets 265 to 293 feet high, and there is a broken chain of rocks running through them. Broken ground on which the least depth found is 9 fathoms lies 1¼ miles southwestward from the southwesterly bare rocks. A rock called **The Whaleback**, 1 mile west of the Haystacks, is 22 feet high, and 300 yards south-southwestward of it is a sunken rock.

Temporary anchorage in 20 fathoms or less can be had in the bight eastward of the Haystacks. A landing can be made on the bowlder beach.

The soundings indicate clear passages between Andronica and the Haystacks, between The Whaleback and the Haystacks, and between the north Haystack and the rest of the group, but none of these passages are recommended.

ANDRONICA ISLAND

is 2 by 3 miles in extent and 1,175 feet high. It is bordered by rocks all around to a distance of 0.2 mile from the shore, and vessels should give the shore of the island a berth of ½ mile. There is a flat islet 22 feet high extending 0.4 mile off the southeast point toward the Haystacks.

The northern point of Andronica is a detached wedge of rock 280 feet high. There is a rock awash at low water 0.7 mile westward of the north point and 0.4 mile offshore, and this is the farthest outlying danger in the approach to Gorman Strait. There is another rock 5 feet high, and 0.2 mile off the western point of Andronica Island.

Temporary anchorage may be found ½ mile from shore in the bight on the northeast side of Andronica, off the sand beach near the northern point, in 20 fathoms. Small vessels can anchor closer to shore in this bight, and also in the bight on the southwest side of the island, and landing can usually be made in one of these bights.

GORMAN STRAIT,

between Andronica and Korovin Islands, has a least width of 2¾ miles, and is clear if the shores be given a berth of ½ mile. In rounding Cape Devine it is well to avoid the broken ground which surrounds this point to a distance of about 1¼ miles in a northeasterly direction and about 1 mile in a southerly direction, until a more detailed development is made.

The currents in Gorman Strait set with the wind, and reach a velocity of 1½ to 2 knots in strong winds. Under ordinary conditions the prevailing set of the current is said to be southwestward in this vicinity.

KOROVIN ISLAND

has two summits; low land and marsh occupies the middle portion; the eastern end is a rocky cliff 1,200 feet high, and the western end is 1,816 feet high.

Sounding has been completed on the south side of Korovin Island from Cape Devine to a point 2 miles southeastward of Henderson Island, and otherwise a few reconnoissance lines only have been run around the island.

Cape Devine, marking the northwest side of Gorman Strait, is a gray headland 855 feet high joined to the southeasterly part of Korovin Island by a low neck. The shore is fringed with rocks and a rock awash at low water lies 400 yards off the south side of the cape. A bank on which the least depth found is 11 fathoms extends ¾ mile southward from the cape.

Scotland Point, the north end of Korovin Island, has shallow water off it. **Scotland Rock**, awash at low water, exists in this locality and is supposed to lie about 1 mile northward of the point, but it has not been located.

Grosvold Bay, 2 miles southwestward of Scotland Point, may be used as an anchorage. The entrance is foul on both sides but safe in the middle, and there is foul ground inside off both the east and west shores. The steamer *Patterson* anchored in the center of the bay, in 8 fathoms, sand and rock bottom.

The bay between Scotland Point and Grosvold Bay is not recommended.

Henderson Island is ¼ mile long, 58 feet high, and lies ¼ mile off the west end of Korovin Island. When approaching from westward it is hard to distinguish Henderson Island from Korovin until close-to. There is shallow water between the two islands, and rocks off the western end of Henderson; it should be given a berth of over ½ mile.

There is anchorage either northward or southward of Henderson Island. The southerly anchorage is eastward of a bare rock about 5 feet high, and the anchorage should be approached from the southward.

The southern bight of Korovin Island has reefs extending 0.3 mile from shore, but affords anchorage 0.6 mile offshore. There is a small settlement in this bight.

Korovin Strait, between Korovin and Popof Islands, has a least width of about 2 miles, and is deep and clear.

KARPA ISLAND

is 0.7 mile by 1.3 miles in extent and 1,373 feet high. It is grass-covered, with a smooth profile, and has a remarkable cliff 900 feet high at the northeast point. The island may be ascended only from the southwest point; 70 yards off this point is a tower rock 50 feet high, and a reef above water extends 140 yards off the southeast point. There is a narrow kelp field along the south and southeast sides of the island, and otherwise there are no known outlying dangers. A few reconnaissance lines of soundings have been run in the vicinity of the island.

POPOF ISLAND

is irregular and rough in shape, with hills ranging approximately 1,000 and 1,500 feet high. The highest point, 1,550 feet, is a short distance northeast of the center of the island. The shores are generally rocky and steep and have many ledges, covered with kelp, extending 200 to 300 yards offshore.

The north and east shores of Popof Island have no outlying dangers, but the shore should be given a berth of about ½ mile. Between Andronica and Popof Islands the water is deep and clear. Temporary anchorage may be found ¼ mile off the north shore of Popof Island anywhere west of Pirate Cove, in 10 fathoms.

Fox Hole, also called Little Harbor, is on the east side of the north end of Popof Island, and is about 1¼ miles long in a south-southwesterly direction. It affords a well-sheltered anchorage for a small vessel, the depths ranging from about 15 fathoms at the entrance to 6 fathoms near the edge of the flat which extends 0.3 mile

from the head. The harbor has a clear width of about 400 yards; foul ground extends over 100 yards in places from the shores, and a reef extends about 250 yards northward from the point on the south side of the entrance of the narrow part of the harbor. The north point of entrance is a sheer cliff, about 150 feet high. The only directions necessary are to keep in mid-harbor.

Popof Head, 980 feet high, is connected to the southeast part of Popof Island by an isthmus. It is a high precipitous headland with a steep slope of talus. There is 20 fathoms 200 yards south of it and the depths increase southward; the 100-fathom curve is 2 miles off. Vessels should give it a berth of ½ mile, although in fog it might be approached more closely.

There are two large bights, with sand beaches, the westerly one known as **Red Cove**, on the south side of Popof Island halfway between Egg Island and Popof Head. Both of the bights furnish anchorage in northerly weather, in 8 to 10 fathoms, sandy bottom. Landing with keel boats is difficult on account of considerable surf and shoal water near the shore. The point separating the bights is a narrow, rocky projection fringed with foul ground to a distance of about 300 yards; rocks awash at low water lie 600 yards from shore and 0.4 and 0.7 mile westward of the point.

POPOF STRAIT (CHART 8891),

between Popof and Unga Islands, is wide and deep at its southern end but is narrow and contains several ledges in its northern part. The principal outlying dangers are as follows:

There is 8 feet on a dangerous pinnacle rock which lies 1.1 miles 207° true (S ¾ W mag.) from the point east of Red Cove; 3 miles 109° true (E mag.) from Egg Island; and 3.6 miles 291° true (W ⅛ N mag.) from Popof Head. It is on a line from the north tangent of Egg Island to the tangent to Popof Head, bearing 111° true (E ⅛ S mag.). Kelp seldom grows sufficiently long to be seen at the surface.

There is about 39 feet on a rocky shoal 1,000 yards 110° true (E ⅛ S mag.) from the first pinnacle rock on the beach south of the entrance to Squaw Harbor; there may be less.

The bottom of the southern part of the strait is broken and irregular, but no other hidden dangers were found. A vessel should keep 0.4 mile off either shore. There are a few settlers along the Unga Island shore.

DIRECTIONS, POPOF STRAIT.

From eastward pass 1 mile southward of Popof Head and steer 288° true (W ⅛ S mag.) for about 5 miles for Hardscratch Point, which leads 1.1 miles southward of the 8-foot rock. When Egg Island bears 323° true (NW by W mag.) steer 337° true (NW ¼ N mag.) for 4.2 miles, passing 700 yards eastward of Egg Island and round Sand Point 0.2 mile off.

Entering from southwestward.—From a position ½ mile off Kellys Rock steer 337° true (NW ¼ N mag.) for 8 miles, passing 700 yards eastward of Egg Island and round Sand Point 0.2 mile off, as before.

After rounding Sand Point at a distance of 0.2 mile steer 52° true (NNE ⅞ E mag.) for Sand Point Wharf for about ½ mile, until Egg Island begins to close on the bottom of the hillside at Sand Point.

Then steer 0° true (N by W ¾ W mag.) for about 1¼ miles with West Head shut in and the point south of it ahead, and Egg Island almost shut in astern, passing midway between Unga Reef and Popof Reef, where the channel has a least width of 400 yards.

When a 33° true (N by E ¼ E mag.) course will clear Range Island by 300 yards, steer that course; the rock 150 yards off the point of Unga Island near Unga Reef will then be right astern and in range with the eastern shoulder of a saw-toothed peak in the Unga range of mountains.

Pass 300 yards off Range Island and when its northwest point bears 180° true (S by E ¾ E mag.) and is in range with the point where Sand Point Wharf is located, bring this range astern and steer 0° true (N by W ¾ W mag.); the change of course is 200 yards east of a 4-fathom shoal.

Bound westward.—After passing West Head, at the north end of Popof Strait, 0.4 mile distant, on a 0° true (N by W ¾ W mag.) course, run 1.1 miles, and change course to 289° true (W mag.) with High Island astern and the tangent to Cape Aliaksin ahead; run 4.7 miles to a position 0.9 mile northward of Gull Island. Then follow directions on page 150.

Bound eastward.—After passing through the strait as above directed, pass about ⅝ mile off East Head and steer 86° true (NE by E ⅞ E mag.) to pass 0.9 mile northward of High Island.

It is difficult to enter Popof Strait from northward at night as there are no prominent landmarks and the entrance is hard to distinguish on account of higher land in the background.

Egg Island lies in the middle of Popof Strait 2½ miles southward of Sand Point. It is 160 feet high, 600 yards across, and grassy on top. **Little Egg Island**, close westward of it, is grassy-topped, 25 feet high, and 130 yards across. There are a few detached rocks about these islands. A vessel should not approach closer than 400 yards, where 15 fathoms or more will be found.

Sand Point is a flat sand spit 0.4 mile long. Its south shore is fringed close-to by rocky ledges and its north shore has sandy bottom. A shoal shelves off about 150 yards westward from the point, and then drops off abruptly to deep water.

Humboldt Harbor (chart 8891) furnishes excellent shelter and good holding ground. Occasional strong southwesterly winds necessitate the use of a second anchor to prevent dragging in this harbor. Passing 0.2 mile off Sand Point steer for Sand Point wharf on a 52° true (NNE ⅞ E mag.) course; anchor in about 10 fathoms about ¼ mile from the shore northward and eastward, with the end of Sand Point bearing 220° true (S by W ⅞ W mag.), and Range Island 30 yards open from the land.

Sand Point wharf, at the head of Humboldt Harbor, is 1.3 miles northeastward of Sand Point. It has a frontage of 42 feet and a depth of 14 feet at low water at the end. A vessel can berth only at the end as there are loose rocks, almost bare at low water, which form a support for the wharf all the way to its outer face. The wharf is not strong. There is a store here, but no settlement.

Popof Reef lies in Popof Strait, westward and southwestward of Sand Point wharf. Its northern part has a least depth of 8 feet, lies 300 to 700 yards westward of the point just northwestward of Sand

Point wharf, and is marked at its southwest end by a black buoy. A vessel may cross the reef in not less than 4 fathoms by passing 100 yards south of the buoy; 250 yards south of the buoy there is a small patch on the reef with 2 fathoms over it.

Unga Reef is described with Unga Island.

A small rocky shoal with 17 feet over it lies in the middle of Popof Strait ½ mile southward of Range Island.

Range Island is 30 feet high and 300 yards across; it is round and grassy over the summit. There is 8 fathoms 100 yards from the northwest end. There is no passage between it and Popof Island.

East Head, on the east side at the north entrance to Popof Strait, has foul ground and kelp for a distance of ¼ mile off its west side and extending southward to Range Island.

Pirate Cove, 4½ miles east-northeastward of East Head, is an important cod-fishing station, with a wharf and an extensive plant; there is a berth at the wharf 100 feet long with 5 to 10 feet at low water. The cove is properly only a boat harbor and it is necessary to warp a vessel in and out. At low tide vessels of a greater draft than 10 feet lie in the mud. Vessels of 250 tons load cargo here regularly.

High Island, ⅜ mile off the northeast part of Popof Island, is ¼ mile long and 310 feet high, with its greatest height near its north end. It is grass covered but has reddish cliffs showing westward and grassy slopes on the other sides. There are 30 fathoms and more 200 yards from it all around and the passage between it and Popof is clear. The island can be passed fairly close to and is a useful mark for making Gorman Strait in thick weather.

UNGA ISLAND,

the largest and most important of the Shumagin group, has several large indentations, among which are Zachary Bay, on the north side, and Delarof Harbor and Baralof Bay (Squaw Harbor) on the east. It is quite mountainous, especially the eastern half. The western half is comparatively low, that part west of Zachary Bay having somewhat rolling topography. The highest mountains are just south of Zachary Bay, where a maximum elevation of 2,270 feet is found. In general, the shore line is rocky and precipitous. The south and west coasts are particularly foul. Near the west end of the north shore is a sand beach 3 miles long with sand dunes immediately back of it. The west shore of the island is not surveyed.

A vessel should avoid approaching the south coast of Unga Island, except in fine weather. There is no shelter or protection, and often a southeast storm comes on suddenly, making it a bad lee shore. It is a bad landfall when approaching from seaward in bad weather, and the currents can not be foreseen. However, all dangers on this side are within ½ mile of the shore.

West Head, the point of Unga Island at the north entrance of Popof Strait, is a black cliff 40 feet high, and ½ mile south of it are cliffs 300 feet high. Westward from West Head the cliffs are higher, broken, however, by numerous valleys. There is 10 fathoms 300 yards off West Head.

Unga Reef extends 0.7 mile south-southeastward from the western shore of Popof Strait, in the narrowest part opposite Sand Point wharf. A small patch lying about ¼ mile off the point is bare about

2 feet at low water, and has ribbon kelp around it. The south end of the shoal, with depths of 3 to 4 fathoms, lies about ½ mile northwestward from the end of Sand Point. The southern part is known as Caton Shoal.

Baralof Bay, locally known as Squaw Harbor, on the eastern coast of the island, about 6½ miles northward of Unga Cape and about the same distance westward from Popof Head, is a good anchorage except in heavy easterly weather. In approaching from southeastward, keep 0.8 mile or more offshore, and in entering the harbor favor, if anything, the north side. Anchor in the middle of the bay in 16 to 18 fathoms, sticky bottom. Small vessels anchor nearer the head of the harbor, in not less than about 6 fathoms. There are three fishing stations in the bay. Vessels may lie across the face of the wharf of the station on the north side of the bay, where there is 12 feet of water at low tide. In the middle of the bay and 1,000 yards from its head is a sandy shoal having a least depth of 24 feet. Fishing vessels use this shoal for a winter anchorage and consider it safe. There is a sandy shoal extending ¼ mile off the south side at the entrance.

Northward of Baralof Bay the shore is more or less foul. A few settlers live along this coast. There is a fishing station in the bight west of Hardscratch Point.

Delarof Harbor (chart 8851), 3 miles northward of Unga Cape, is not sheltered except in northwesterly weather, and the holding ground is bad. The depths in the outer harbor range from 15 fathoms at the entrance to 5 fathoms about 300 yards outside the entrance to the inner harbor. It is not safe to anchor in less than about 6 fathoms.

Approaching the harbor from either direction, several rocks and islets are found close inshore. **Halfway Rock**, 70 feet high and 90 yards in diameter, lies 200 yards offshore about ⅝ mile inside the north entrance point. **Cross Island**, 265 feet high, lies midway of the north shore. **Elephant Rock**, 155 feet high, is a small projecting point a short distance inside the south entrance point. A rock 40 feet high lies 300 yards off Elephant Rock, to which it is connected by a reef.

A dangerous shoal known as the **Blind Breaker**, which is bare at extreme low water, lies in the entrance 850 yards 180° true (S by E ¾ E mag.) from the southeast end of Cross Island, and about 1 mile 119° true (E ⅞ S mag.) from the south entrance point of the inner harbor. The rock is closely surrounded by depths of 12 to 14 fathoms.

A shoal with 20 feet at mean lower low water lies in the center of the anchorage off the town, about 650 yards 122° true (ESE ⅞ E mag.) from the south entrance point of the inner harbor.

Enter Delarof Harbor on a 287° true (W ½ S mag.) course, heading for the point on the south side of the entrance of the inner harbor, which leads ¼ mile northward of the Blind Breaker.

A mile from the entrance is a narrow constricted passage beyond which the bay is shoal. In the center of this inner harbor is a large reef which is exposed at extreme low water. **Flagstaff Hill**, 80 feet high, is the rounded point, surmounted by a flagpole, at the north side of the narrow passage to the inner harbor. **Unga**, the largest settlement in the Shumagin group, lies back of this hill and consists of a fishing station, 3 stores, a post office, a jail, a church, and about 30 houses. The population in 1910 was 108. There is no wharf

where vessels may lie. On the south side of the harbor near the entrance is the wharf of a fishing station, the end of which is bare at low water. At the head of the harbor is the wharf of the Apollo Mines, approached only at high water. A ledge bare at low water lies 400 yards southward from Unga wharf. Small boats anchor in 2 or 3 fathoms in the middle of the narrow entrance inside of this ledge.

Kellys Rock marks the southwest side of the southern entrance to Popof Strait. It is a flat-topped, grassy islet 65 feet high, 160 yards across and 200 yards offshore. There is 14 fathoms 175 yards offshore from it. Vessels should give it a berth of ½ mile or more. There is a fishing station in the bight a mile west of Kellys Rock, and this is the only one in the vicinity which is open all the year.

Unga Cape, the southeast point of Unga Island, is a bare, gray, rugged cliff 855 feet high. A wall-like slab of rock 500 feet high, connected to the cape by a narrow bar, stands just south of the cliff and perpendicular to it. There are ledges at the foot of the cliff. A vessel may pass ½ mile off in 25 fathoms.

Sealion Rocks, 3 miles south-southeastward of Unga Cape, are 0.2 mile in extent, 130 feet high, flat-topped and grassy. There is a breaker 0.4 mile northeastward of them. A vessel may pass ½ mile off in 26 to 32 fathoms but should give them a greater berth. There is a clear width between Sealion Rocks and Unga Cape of 2½ miles, with depths from 20 to 30 fathoms and no outlying dangers.

Acheredin Bay is a large open bight in the south shore of Unga Island. It is 3 miles across and 2 miles deep. Its shore is a sand and pebble beach, behind which is a lake 7 feet above high water. A vessel may approach to 0.6 mile off the sand beach in 8 fathoms.

Acheredin Point, the southwest end of Unga Island, is a black mountain 1,400 feet high, with an exceedingly rough surface and serrated profile. At the end of the point is a separate hill 500 feet high. A vessel should keep 1 mile off.

The west side of Unga Island is unsurveyed.

Bay Point, or **Nigger Head,** is a rocky headland of rounded profile, 325 feet high, which forms a good landmark all around, and shows over the land in Unga Strait. There is said to be anchorage in 7 fathoms northward of Bay Point affording good shelter for northeasterly winds.

The northerly point of the island terminates in a sand spit surrounded by shoal water to a distance of about ¼ mile offshore in a northerly direction and to greater distances on either side.

Under favorable weather conditions a fair **anchorage** may be found in 5 to 7 fathoms, sand bottom, ¾ mile 280° true (W ¾ S mag.) from the sand spit on the north shore of Unga Island. Small vessels can anchor closer to shore off the western side of this spit in as little as 4 fathoms in places. About 2 miles southwestward of this spit to the beginning of the rocky shore line the 5-fathom curve is about 1 mile offshore.

Gull Island is a flat-topped, grassy islet about 50 feet high and 80 yards across. It is 0.9 mile off the west side of the entrance of Zachary Bay. The island has deep water all round it as close as 200 yards. There is a passage with a clear width of ½ mile inside of the island, but care should be taken to avoid the reef extending from the west entrance point of Zachary Bay.

ZACHARY BAY (CHART 8891),

on the north side of Unga Island, is 6 miles long and 2 miles wide at the entrance, narrowing to about 1 mile in the middle of the bay. It is open and easily entered. The outer part of the bay has depths of 10 to 20 fathoms, sticky bottom, affording anchorage, but is exposed to northerly and northeasterly winds. The principal dangers are as follows:

Two small reefs, known as **Weedy Shoals**, which show well at low water, lie ¼ mile from the eastern shore halfway from the entrance to North Head. A kelp-marked ledge, bare at low water, extends nearly ⅝ mile northeastward from the western shore at the entrance; the end of the ledge lies 1.1 miles 162° true (SE ¾ S mag.) from Gull Island.

The best anchorage for vessels in Zachary Bay is about ¼ to ⅜ mile from the eastern shore and ½ to 1 mile southward of Round Island, in 8 to 12 fathoms, sticky bottom. **To enter**, pass North Head on a 178° true (S by E ⅞ E mag.) course for the west end of Round Island in range with the middle of a saw-toothed mountain, which leads ¼ mile westward of North Head. Then pass about 200 yards westward of Round Island, and follow the eastern shore southward at a distance of ¼ to ⅜ mile. The principal dangers are as follows:

A rock with 20 feet over it lies 300 yards westward of **North Head.** An extensive shoal makes out from the western shore from northward of North Head to the head of the bay, the 5-fathom curve, on the eastern edge of the shoal, passing 700 yards westward of North Head and 350 yards westward of Round Island; southward of Round Island the edge of the shoal is steep-to. The head of the bay is shoal southward of the point on the east shore 1.4 miles southward of Round Island.

Coal Harbor (chart 8891) is the best anchorage for small vessels in Zachary Bay. The berth with best swinging room is ¼ mile north-northeastward of **Quartz Point**, with North Head just open from the western entrance point of the bay, and **Range Islet** bearing 260° true (SW by W ⅜ W mag.), in 7 fathoms, sticky bottom. The best entrance is in mid-channel northeastward of Round Island, and then follow the northeast shore at a distance of 300 yards. The principal danger is a spit, bare only at extreme low water, which extends 600 yards 120° true (E by S mag.) from Round Island; the range of North Head and the western entrance point of the bay leads over the easterly edge of the spit, and vessels should keep eastward of this range when Range Islet bears 230° true (SSW ¾ W mag.). The head of the harbor southeastward of Quartz Point is shoal.

There is an abandoned coal mine on the west side of Zachary Bay.

UNGA STRAIT,

separating Unga Island from the Alaska Peninsula, is 2¾ miles wide in its narrowest part, between the sand spit on the north side of Unga Island and Cape Aliaksin on the peninsula. Depths of 16 to 30 fathoms are found in this part of the strait. A vessel should keep ¾ mile off either shore.

A patch of what looked like growing kelp was seen 1.1 miles 0° true (N by W ¾ W mag.) from the sand spit on the north shore of

Unga Island. The least depth found in the locality is 22 fathoms and no trace of this kelp was found in 1915 by a surveying vessel. However, as a precautionary measure, this spot should be avoided by deep-draft vessels.

Currents.—In general, currents set in the direction of all courses from Sand Point to Pavlof Bay. In Unga Strait a 0.4 knot current will generally be found setting westward; it does not change with the tide except between Unga and Popof Reefs, where a tidal current with a velocity of 1 knot, at strength, sets northward on the flood tide and southward on the ebb.

CAPE ALIAKSIN TO BELKOFSKI.

The surveys of this region consist of a few lines of soundings in the channel from Cape Aliaksin to Volcano Bay, and of complete surveys of Volcano Bay, the north and west sides of Dolgoi Island, Goloi and the Iliasik Islands, the passages between the various islands, and the waters for about 3 miles westward of the Iliasik Islands.

Beaver Bay lies west of Cape Aliaksin and is 3½ miles wide at the entrance. It was not examined, but a narrow opening or "hole in the wall" was seen at the head of it, which probably leads to Otter Bay. **Otter Bay** is reported to be closed by a shingle spit. On the western side of Beaver Bay the land is low, and rises gradually for 12 miles west-southwestward. The shore is not much indented and consists of a line of low cliffs with occasional waterfalls. The point on the west side of Beaver Bay is called **McGintys Point.**

A single line of soundings at a distance of 2 miles from the shore showed depths less than 10 fathoms, irregular bottom, for a distance of 5 miles southwestward of the southwest point at the entrance of Beaver Bay. The least depth found was about 4 fathoms at a point 2 miles from shore and 7.4 miles 300° true (W by N mag.) from Bay Point (Nigger Head), Unga Island.

Hair Seal Cape at the entrance to Pavlof Coal Bay, is low and difficult to recognize. It terminates in a flat-topped mound 100 feet high, connected to the mainland by a low neck of land. Lying 3 miles eastward of it is a southerly projecting point which appears to be cut off to form an island; and 1 mile east-northeastward of this in turn is a rocky ledge 0.8 mile offshore and showing 8 feet above water. Both these may be picked up when skirting the shore in foggy weather; a vessel following the shore will be in 18 fathoms when heading for the ledge, as she proceeds westward. Abreast of this ledge, about ½ mile inshore from the beach, is a hog-back mountain 1,100 feet high.

Moses Rocks consist of two breakers about 0.3 mile apart, which lie 0.6 mile southward and south-southwestward from Hair Seal Cape, and 270° true (WSW ¼ mag.) from the end of the point 3 miles eastward of Hair Seal Cape. The lead gives no warning of these breakers. A depth of 10 fathoms, irregular bottom, and no development, was found 1 mile south-southeastward of Hair Seal Cape.

Pavlof Coal Bay is a good shelter for small vessels in northerly weather. It looks east-northeastward up a broad valley, behind the 1,100-foot hill already mentioned, and is entered on a 65° true (NE ⅛ E mag.) course. To avoid Moses Rocks when entering, round the cape at a distance of 0.3 mile in 11 fathoms, or at a distance of

1¼ miles in deeper water, following the shore from Broad Cape. A depth of 4 fathoms was found near the middle of the bay north-northwestward of Hair Seal Cape, and no sounding was done farther northward and eastward.

Broad Cape has a bold shore, curved in outline; there are two mountains on it, close together, about 1,800 feet high There are two small islands near the shore between Pavlof Coal Bay and the cape. There are 27 to 60 fathoms 1¼ miles off the cape.

Pavlof Bay was not examined. The course from Broad Cape to Volcano Bay was sounded over and found safe. The west shore of Pavlof Bay is called **Long Beach.**

Arch Point, the north point at the entrance to Volcano Bay, is moderately low with cliffs about 100 feet high at the water, and is joined by a low neck to the high ground farther back. It is undercut in several places, forming caves and arches. The eastern part of the cliffs are of basalt of a marked columnar structure, appearing like a vast stockade. The rock is dark near the water, changing to light brown above. The land back of it is grassy. Deep water extends close to the south side of the point. A rock with 11 feet over it lies a little southward of a line from Arch Point to the north end of Dolgoi Island, and on the range of Bluff Point and the southeasterly tangent of Moss Cape. Broken ground, on which the least depth found is about 6 fathoms, and which should be avoided, extends ½ mile eastward from the 11-foot spot.

Volcano Bay is free from rocks and shoals, except near the shores which should be given a berth of about ⅜ mile. The shoaling is abrupt from about 30 fathoms to the north side of the bay. Shelter, except from southeasterly winds, and good anchorage may be had near its head in 10 fathoms, sticky bottom. Shelter for small vessels from southeasterly winds may be had in 2 fathoms behind the sand spit in the northwest corner. Fresh water can be obtained here. Rocks and ledges extend 500 to 700 yards from the shore between this spit and Bear Bay. The inner part of **Bear Bay** can be entered only by pulling boats. A fair anchorage, exposed only to northeast winds, can be had in the middle of the entrance to Bear Bay, in 15 to 20 fathoms. The lagoon on the north side of Volcano Bay is full of bowlders and is nearly dry at low water.

PAVLOF ISLANDS.

This group consists of Wosnesenski, Ukolnoi, Poperechnoi, Dolgoi, Goloi, and the two Iliasik Islands. Between Unga Island and Dolgoi Island the islands and bare rocks are fairly well located. The surveyed area near Dolgoi Island and the coast southwestward to Thin Point are shown on chart 8703.

Jude Island is about 150 feet high, and about ½ mile across, round in profile, grassy on top, and rocky at the shore. There was a herd of about 200 sea lions on it in 1913. Deep water extends close to the northwest side of the island. Dangerous rocks may be found on a line from Jude Island to Bay Point and from Jude Island to Wosnesenski Island. Breakers were seen in these localities and a vessel should keep 1 mile or more northward.

Wosnesenski Island has a rocky, flat-topped peak 1,200 feet high near the southeast point, and the remainder of it is lower; there is a

lagoon occupying the northeast portion and a small settlement on the north shore. A vessel may anchor in the bight on the north shore ½ mile westward of a bare ledge. Otherwise the shore seems foul all around, and depths of 10 to 15 fathoms are found northeastward for 2 or 3 miles and probably dangerous rocks exist also.

Ukolnoi Island is steep and bold at the northwest point. East of the island are several rocks and ledges showing above water as far as the longitude of Wosnesenski Island, and there appears to be foul ground right across. In case it should be necessary to pass through a channel might be found by skirting Wosnesenski Island. Along the south shore of Ukolnoi Island there are several breakers 0.3 to 1.8 miles offshore.

Poperechnoi Island has rugged cliffs 1,300 feet high along its northeast shore. There is a rock awash at half tide 1.3 miles from the northwest point of it, on a line toward Wosnesenski Island, and another breaker 1.3 miles east-northeastward of this rock. Still farther east is a pinnacle rock well above water, in the middle of the strait. No sounding has been done.

Dolgoi Island, 11 miles across and grass covered, is divided into two mountain masses by Dolgoi Harbor and the lowland at its head. The greatest heights at the east and west ends of the island are 1,450 and 1,510 feet, respectively. The shore is generally abrupt and high. The north point of the island is an overhanging cliff.

Bluff Point, the northwest end of Dolgoi Island, is a rocky headland 50 feet high with a grassy slope eastward. Deep water extends fairly close to the northwest end of the island. The south part of the island is particularly bold, the cliffs being several hundred feet high. At the middle of the southeast side is a headland with a cliff 920 feet high.

Dolgoi Cape, the south point of Dolgoi Island, is marked by several large, detached rocks a few yards off the shore line.

Dolgoi Harbor (charts 8703 and 8851) is the safest and most commodious harbor in this part of Alaska, giving perfect shelter and freedom from williwaws. There are two islets on the west side of the entrance and two larger islands inside the harbor.

To enter Dolgoi Harbor, steer 20° true (N ⅛ E mag.) for the highest point (500 feet) of the ridge at the head of the harbor showing westward of the two islands in the harbor, and pass 200 yards or more eastward of the outer one of the two islets on the west side of the entrance. Pass westward of the first island in the harbor, favoring if anything the island side.

The deeper passage then leads between the two islands in Dolgoi Harbor, taking care to give the north end of the south island a berth of over 150 yards, and the southeast end of the north island a berth of over 300 yards; the best course through is about east (mag.). Or, vessels can take the passage west of the upper island, which has a depth of about 4 fathoms, by keeping the island aboard at a distance of about 200 yards. Anchorage can be selected anywhere inside the island, the depths being 7 to 10 fathoms, mud bottom, with no outlying dangers. Water can be had from the waterfall on the eastern shore abreast the first island. The passage eastward of the first island is not recommended.

Dolgoi Harbor is easily approached with the aid of the chart, passing on either side of Goloi Island. The principal outlying dangers in the

approach are two rocks with 1 foot over them, which lie about on the range of the east point of Goloi Island and the end of the spit at the west end of Dolgoi. One rock lies 0.7 mile 135° true (SE by E ⅝ E mag.) from the east end of Goloi Island; the other rock lies 0.9 mile 222° true (SSW ⅛ W mag.) from the cluster of rocks at the southeast side of the entrance of Dolgoi Harbor.

Goloi Island is 970 feet high and the sides are generally abrupt except at the two sand spits, one at the west end, the other at the middle of the northeast side of the island.

Iliasik Islands are each about 2.7 miles long and 0.7 mile wide. They are both high and generally have cliffs at the water. Viewed from Cape Bold they appear as three islands, as **Inner Iliasik** is nearly divided by a low neck of land into parts about 800 feet high. The high north end of **Outer Iliasik** is also separated by low ground from the rest of the island. There are ledges and kelp extending about 200 yards from the east side and about ¼ mile from the west side and southeast end of Inner Iliasik. Outer Iliasik is surrounded by ledges and kelp to a distance of ¼ mile in places; bare rocks and foul ground extend ½ mile west-southwestward from the west end of the island. Growing kelp was seen midway between the islands in midsummer.

From the north point of Inner Iliasik Island there is a reef extending to the mainland. Just east of the mainland end of the reef and close to the shore is a large bowlder which is easily recognized. There is little depth on the reef near the island, and about 8 feet on the greater part of it. Near the mainland a depth of 11 to 12 feet can be taken across the reef by passing 100 to 300 yards off the large bowlder on a course parallel to the shore. The passage is used by local fishing vessels of about 6 feet or less draft, and is not recommended for any but light-draft vessels; the tendency is to cross too far from the large bowlder.

Sandman Reefs, a large area of foul ground with numerous islands, islets, and rocks, extends in a southerly direction from Deer and Outer Iliasik Islands almost to the Sannak Islands, and in an easterly direction to beyond Pinnacle Rock. This area is unsurveyed and the passage between them and the Sannak group should be used with great caution.

BELKOFSKI TO IKATAN BAY.

Belkofski, a native settlement, consists of a church and about 25 houses. The church is painted white and is prominent. Vessels anchor off the village in 10 fathoms and land goods on the sand and bowlder beach unless southerly weather makes the surf too heavy.

Belkofski Bay is deep and free from hidden dangers so far as known, except for reefs and ledges near the shore. There are rocks 600 yards off **Cape Belkofski**, the east point of entrance. Vessels entering should give the shore a good berth, as the bay has not been surveyed. A mile north of Cape Belkofski and running in range with it is a long, high ridge, the upper part bare and gray colored, the lower slopes grassy, but with gray streaks where broken rock has slid from above.

Kitchen Anchorage is easy to reach and offers good shelter. Soft mud is found at the head of the harbor in 10 or 12 fathoms. The bottom slopes from 15 fathoms at the entrance to 10 fathoms near

its head, the 3-fathom curve being about 150 yards offshore. A fresh-water stream flows into the head of the harbor.

Bailey Harbor is the name given to the indentation opening from the northeast corner of Belkofski Bay 1 mile north of Kitchen Anchorage. It is entirely landlocked, being shut in by a broad shingle spit, and is regarded as a secure anchorage for small vessels. There is 5 to 8 fathoms near its center, and about 9 fathoms through the middle of the narrow entrance. In the absence of a survey it would be prudent to anchor off the inner side of the shingle spit near the entrance. There is a long, winding lagoon about 200 yards wide running inland from the head of the bay. There is 8 fathoms 200 feet off the end of the sand spit at the entrance to the lagoon.

Cape Bold is a rugged headland faced with vertical cliffs, above which the mountain rises in steep rock-strewn slopes. Several prominent bowlders stand a few yards off the shore.

Kings Cove is at the head of a deep, narrow valley stretching inland between high ridges which rise from the shore on either side of the cove. The outer bay is deep and free from dangers except those close to shore. Vessels may anchor in 10 to 17 fathoms close to the sand spit off the wharf and eastward from it. The bottom rises very quickly not far from the shore. Vessels of considerable size (2,000 tons or more) can lie across the head of the cannery wharf. Williwaws are violent and even dangerous. To enter steer 0° true (N by W $\frac{5}{8}$ W mag.) for the cannery wharf. Some local magnetic attraction has been observed in the vicinity; 32° easterly variation was obtained by observation at **Vodapoini Point**, the east entrance point to Cold Bay, but the extent of the area affected is not known.

At the head of Kings Cove a long spit projects across from the east side, and is overlapped by a shorter spit from the west side. From the spits the inclosed lagoon extends 2 or 3 miles inland. There is probably 3 fathoms over most of it and as much as 17 fathoms is reported, but it can be entered only at high water. Small vessels can anchor behind the western spit, but they should have local knowledge to avoid the shoals near the entrance. The tidal currents have a velocity of about 5 knots at strength in the entrance, sweeping eastward along the outer side of the long sand spit on the ebb and keeping the bottom deep close to it.

Deer Island is a series of high conical peaks, many of which are so nearly of the same elevation as to be recognized with difficulty from different positions. The north shore is determined by a good reconnaissance, but the limits only of the other sides are shown. **Stag Point**, at its north end, is a short sand spit, except for which the shore is rocky and steep. Back of the point is a high sugar-loaf peak. The point may be recognized by a steep, high, triangular-shaped bluff at the end of a shoulder of the peak which is conspicuous in the otherwise sloping sides. Anchorage is reported on the east side of the spit. **West Cape** is a ridge of bare rock ending in sheer faces at the western extremity and at the two sides.

Approaching Deer Island from westward Fox Island shows up low and irregular and is not very distinct until some time after passing Umga Island, unless the weather is exceptionally clear. West Cape of Deer Island shows as a flat-topped sugar loaf, apparently a detached island, but later is seen as a part of Deer Island, while at the same time Stag Point shows as a high sugar loaf beyond West Cape. South-

ward of West Cape are two barren, crater-like peaks, which form an excellent landmark.

Current.—Eastward of Deer Island the flood current sets northward and the ebb southward.

North of Fox Island the flood current sets northeastward and the ebb southwestward.

Fox Island Anchorage, on the east side of **Fox Island,** offers good anchorage in 8 to 9 fathoms, soft bottom, well sheltered from the wind and sea from northeastward to southeastward. Between West Cape and the shacks at the mouth of the stream a valley extends through southward to the west side of Deer Island. Bring this valley to bear 184° true (S by E ¼ E mag.) and steer for it, and anchor when Amagat Island opens south of Fox Island.

Cold Bay is not surveyed and no description is available.

Thin Point is a long, grassy, low, flat or gently sloping, sand and gravel point. The extremity is an eroded yellow sand bank, westward from which is a reef bare at low water. On the point about 2½ miles from its end there is a symmetrical, dome-shaped, grassy hill which stands out conspicuously as the only high ground near the point.

An extensive, and probably dangerous, shoal, rocky area surrounds Thin Point. Only a few lines of soundings have been run over this area, and as a measure of caution vessels should proceed with care in this vicinity when crossing areas with a depth less than 10 fathoms. The principal part of the shoal is apparently on a line of the point extended, and is in the form of a bar probably extending to the southwest side of Deer Island. The least depths found by the survey near the sailing line between Fox Island and Umga Island are 6 to 7 fathoms, but the bottom is very broken. A depth of 14 feet was found 1.2 miles southward of Thin Point, and 3 fathoms 3.2 miles southeastward from the point.

Sozavarika Island is low and grassy and lies 3 miles southwestward of Deer Island. It may be approached as close as 500 yards on its northwestern side, where there is 15 fathoms, sand bottom. Between this island and Deer Island there are sunken rocks, and other rocks are reported in the line between it and Umga Island.

Umga Island is small, rounded, grass covered, and rocky. It is 250 feet high and has a survey signal at its highest point. There is 40 fathoms close to the northwest and southwest sides, but foul ground is said to exist eastward and southward of it.

Amagat Island is high, bold, and shows as two abutting parts; the southeast part is 1,030 feet high and sharp, while the other part is lower (600 feet high), broader, and flat-topped.

Morzhovoi Bay is not surveyed and no description is available.

SANNAK ISLANDS

are the southwestern islands of the groups off the southern side of the Alaska Peninsula. They consist of two large islands, Sannak and Caton Islands, and a great number of small islands and rocks southward of the former, 20½ miles long and 10½ miles wide, and all bare of trees. **Sannak Mountain,** at the northwest end of Sannak Island, is the prominent object seen in approaching the group, and is about 3 miles long and 1 mile wide. It is a central peak (Sannak

Peak) 1,700 feet high, in latitude 54° 28′ N., longitude 162° 45′ W., with a shoulder on its east side about 1,300 feet high and one on its west side about 700 feet high. At 4½ miles eastward from Sannak Peak this ridge again rises to over 200 feet, but all the remainder of the group is but little over 100 feet high on the northern side, decreasing to less than 40 feet high among the islands and rocks forming the south side.

From time to time sunken rocks and breakers have been reported in numerous localities northward and northwestward of Sannak Islands; no definite information can be given about them, but their reported positions are shown on Coast and Geodetic Survey Chart 8860. Crowley Rock is the only known danger. The eastern end of **Caton Island**, the eastern end of the group, is fringed with reefs and breakers to a distance of over 1 mile. With perhaps the exception of Peterson Bay, the entire south side of Sannak Islands is dangerous for a stranger to approach, especially the southwest end. The principal outlying known dangers are:

Crowley Rock, lying 1½ miles off the north side of Sannak Island and 348° true (NNW ¾ W mag.) from Sannak Peak, is several small pinnacles very close together. The least depth found was about 11 feet, though there may be less, and there are depths of 9 to 15 fathoms close-to.

The western end of Sannak Island is fringed with rocks. The westernmost known break lies 1 mile 267° true (WSW ⅛ W mag.) from the northwesternmost bare rocks of the group, and nearly 2 miles 281° true (W ⅝ S mag.) from the west point at the entrance to Acherk Harbor.

A reef, with five rocks which show above water, lies between 4 and 5 miles southwestward of Clifford Island. What is supposed to be **Hennig Rock** is the northernmost rock of the reef, and is nearly on the range of Sannak Peak and the western end of **Troitz Island**, the middle and largest Trinity Island, bearing 71° true (NE ⅝ E mag.), distant 3½ miles from the island. **Oneida Rock**, 4 miles 162° true (SE ⅝ S mag.) from Hennig Rock, is the southernmost rock of the reef. It lies 5 miles from Clifford Island and 224° true (SSW ¼ W mag.) from Sannak Peak.

A narrow bank about 5 miles long in a 120° true (E by S mag.) direction is reported to lie 7 miles southwestward of Clifford Island. Depths of 2 to 7 fathoms were found on it, and it is marked by kelp at slack water. The least depth was found at its northwest end, which lies 12 miles 238° true (SW ½ S mag.) from Sannak Peak.

Aleks Rock is in latitude 54° 20′ N., longitude 163° 10′ W., and lies 16¾ miles 241° true (SW ¼ S mag.) from Sannak Peak. It is the farthest outlying known rock southwestward of Sannak Island. The least depth found was 9 fathoms, but it is reported to break with an ordinary swell.

Anderson and **Leonard Rocks**, **Davidson Bank**, southwest of Sannak Island, long of doubtful existence, have been removed from the charts. Repeated systematic searches of several months duration, in all weathers, have failed to indicate shoals in the vicinity where these rocks were reported. All reported positions of them are along the edge of the bank. The bottom is extremely level and regular to the 100-fathom curve and drops abruptly there. The vessels making the survey carried submarine sentries set at 30 to 40 fathoms,

but no dangers were found. The current runs westerly; with an easterly wind it reaches a strength of ¾ knot. It runs south of west when the wind is north of east, and runs north of west when the wind is south of east. Along the 100-fathom curve it reaches a strength of more than 1 knot. Tide rips are often seen here.

The anchorages at Sannak Islands are suitable for small or moderate sized vessels only, and with the exception of Caton Harbor there are no harbors affording shelter from all winds.

Acherk Harbor, at the northwest end of Sannak Island, is ¾ mile long and about ¼ mile wide, and affords a contracted anchorage for small vessels with protection from southerly and westerly winds, but is exposed to winds from northwest to east, and a swell makes in with strong westerly winds. There is a small settlement at the southeast corner of the harbor, at which there is a boat landing, and water can be obtained by boats. The mean rise and fall of the tide is 5.1 feet.

Approaching Acherk Harbor from northward and eastward there are several reported dangers, the positions of which are shown on Coast and Geodetic Survey Chart 8860, but the only known danger is **Crowley Rock**; the safest way to avoid this rock in coming from eastward is to keep within ¾ mile of the north shore of Sannak Island from abreast Northeast Point. **Approaching from northwestward** steer for the western hill or shoulder (about 700 feet) of Sannak Mountain on any bearing between 140° true (SE by E ¼ E mag.) and 176° true (SSE mag.); the former bearing leads about ¾ mile northward of the northernmost bare rocks off the western end of Sannak Island, and the latter bearing leads about ¾ mile westward of Crowley Rock. When off the entrance steer 193° true (S ½ E mag.) for the middle of the entrance. Keep in mid-harbor until the peaks of Sannak Mountain are in line and the row of houses on the east side are directly under them, and anchor in 5 to 6 fathoms, hard bottom. There are sunken rocks off the points at the entrance, but they are marked by kelp and can be readily avoided.

Murphys Crack is a small indentation about 1¼ miles east of Acherk Harbor. It is protected by a reef and affords shelter for the boats of the fishermen who live here.

Pavlof Harbor is a small bay about 1 mile east of the eastern base of Sannak Mountain. It is reported to be a good harbor for small craft, but requires local knowledge because of the protecting reefs at the entrance, and vessels drawing more than 7 or 8 feet can not use it. There is a fishing station here.

Unimak Cove, 1¼ miles east of Pavlof Harbor, is an open bight, and unimportant.

Johnsons Bay, 1½ miles west of Northeast Point, has an inner harbor for boats and small craft, where there is a fishing station, and vessels may anchor just inside the entrance to the bay, favoring the east side, in about 9 fathoms, with protection from southerly and westerly winds. There are some rocks close to the west point at the entrance.

Northeast Bay, at the northeast end of Sannak Island, affords anchorage with shelter from northwest and southwest winds, but is exposed to easterly winds. **Northeast Point**, forming the north side of the harbor, is about 100 feet high. **Eagle Rock**, about 50 feet high, lies near the middle of the harbor; it is surrounded close-to by a

ledge which covers, and a sunken reef connects it with the head of the harbor. Water can be obtained by boats at the head of the harbor.

To enter give Northeast Point a berth of about ¼ mile and anchor between the point and Eagle Rock, slightly favoring the point, with Chernabura Island just open of Northeast Point, in 6 to 9 fathoms, sandy bottom.

Lida Anchorage is a temporary anchorage in southerly winds, at the west end of Caton Island, south of Lida Island, and which may be entered on either side of the latter.

Approaching from eastward stand in near the visible rocks off the east end of Lida Island, taking care to avoid the partially covered reef, nearly ½ mile eastward of **Lida Island**, which extends in a northerly direction from Caton Island. Anchor about ¼ mile from Caton Island, and ¼ to ½ mile southward of Lida Island, in 6 to 7 fathoms, sandy bottom; care should be taken not to approach the south side of the anchorage.

Approaching from westward steer for the southwestern side of Caton Island on a 144° true (SE ⅞ E mag.) course, passing about ⅜ mile southward of Lida Island, and leaving a rock awash, lying ½ mile northward from Wanda Island, about ⅜ mile on the starboard hand, and anchor as directed above. The western end of Lida Island should not be approached closer than ½ mile.

Caton Harbor is a large area with general depths of 2 to 3 fathoms, sandy bottom, on the southwest side of Caton Island, protected on the south by **Elma Island** and on the northwest by the islands and reefs, above water in many places, between Caton Island and Sannak Island. It is protected from all swells, and schooners of considerable size have wintered here. The entrance is narrow and is close to the west end of Caton Island; there is another entrance, crooked and very narrow, between Elma Island and the southeast end of Sannak Island, but its approach from southward is full of rocks and reefs, and it should not be used except with local knowledge.

To enter Caton Harbor from northward proceed as directed for entering Lida Anchorage from westward, and when well past the rock awash, mentioned under Lida Anchorage, bring the south side of the rock awash in range with Northeast Point astern, and stand in keeping the range astern, course 125° true (ESE ½ E mag.), until close to Caton Island. Then keep the bare rocks and kelp projecting from Caton Island close aboard on the port hand, but do not approach the kelp on the starboard hand; the least depth found in the narrowest part of the passage was 4½ fathoms, shoaling inside to 3½ and 3 fathoms. When past the rocks on the port hand steer about 193° true (S ½ E mag.) about ½ mile, and anchor in about 3 fathoms with **Princess Rock** (high, grassy on top, extensive surrounding reefs covered at high water) in line with Sannak Mountain, bearing 294° true (W ½ N mag.). This anchorage is about ½ mile from Caton Island, and the same distance from the nearest reef on the western side. Anchorage, with probably better shelter from northeast gales, can be made off the sand beach on Caton Island, just inside the narrow entrance.

Peterson Bay, on the south side of Sannak Island, is well protected from all but southeast winds, especially for small vessels, of 12 feet or less draft, which can anchor well inside the bay abreast the village

which is on the north side. The people living here say that in heavy northeast winter gales a heavy swell makes into the bay. The bay is over 1½ miles long 300° true (W by N mag.), nearly ½ mile wide at the entrance and ¾ mile wide at the head, with about 5 fathoms at the entrance and shoaling gradually toward the head, where there is 12 to 14 feet in the widest part of the bay. There is a spot with 11 feet over it 350 yards off the south side and 344° true (NW by N mag.) from the south point at the entrance. The mean rise and fall of the tide is 4.4 feet.

To enter, in approaching from eastward give the east and southeast sides of Caton Island a berth of about 2 miles to clear the reefs and breakers which extend more than 1 mile offshore, and steer 262° true (SW by W ⅝ W mag.) passing 1 mile southward of Umla Island and Telemitz Island. When the latter island is abeam bring the tangent of the north side of Peterson Bay in line with the slight saddle between Sannak Peak and the eastern shoulder of Sannak Mountain, and run in on this range course 318° true (NW by W ⅜ W mag.). When the south point of the bay is about ¾ mile distant, haul northward a little so as to bring the north side of the bay in line with the extreme southwest tangent of Sannak Mountain, and run in on this range, course 311° true (WNW mag.), until the south point at the entrance bears 187° true (S by E mag.). Then steer 294° true (W ½ N mag.) for the middle of the bay and select anchorage according to draft.

IKATAN BAY AND ISANOTSKI STRAIT

separate Unimak Island from the Alaska Peninsula, and have been used by light-draft craft, intended for service on the Yukon River, in making the passage from Puget Sound ports to St. Michael. But the strait is subject to very strong tidal currents, and the northern entrance is shoal and requires local knowledge. Northerly winds draw through the strait with great force.

Ikatan Bay, on the north side of Ikatan Peninsula, is about 3¾ miles wide and 5 miles long in a southwest direction, and is free from surf except with winds from north to east. **Sankin Island,** lying 1 mile from the north side of the bay, is high, with a rounded, grassy summit; a reef extends from the island toward the nearest point of the peninsula. **Sankin Bay,** northwest of Sankin Island, is reported to be shoal. There is no passage north of Sankin Island.

The southwest end of Ikatan Bay is separated from Otter Cove by an isthmus, 20 to 30 feet high; a river enters Ikatan Bay at the middle of this lowland, and a submerged spit, which drops off abruptly to over 20 fathoms, makes off from its mouth.

Approaching Ikatan Bay from southwestward the only known danger is **Pankof Breaker,** lying a little over 2 miles 53° true (NE by N mag.) from the southeast point at the entrance to East Anchor Cove. To avoid the rock, round Cape Pankof at a distance of 1 mile and steer 325° true (NW ¾ W mag.), following the northeastern coast of Ikatan Peninsula at a distance of 1 mile.

There is a good anchorage in the bight on the west side of **Ikatan Point,** the south point at the entrance to the bay, in about 9 fathoms, sand and mud bottom, with protection from winds from southeast to southwest; water can be conveniently obtained here. Salmon traps will be seen in this bight.

The best anchorage in Ikatan Bay from all southerly winds is on its south side off the low divide leading to Dora Harbor, and 174° true (SSE ⅛ E mag.) from Sankin Island. In approaching this anchorage bring Bird Island in sight over the middle of the lowland, and anchor in any depth desired, as it shoals gradually to the beach. Anchorage can also be made on the north side of the bay, 2¼ miles westward of Sankin Island, in 10 fathoms, sandy bottom, sheltered from ordinary northerly winds, but badly exposed to easterly and southerly winds.

Isanotski Strait has its southerly entrance at the northwest end of Ikatan Bay. This entrance is narrow, and a reef projects from the east point at the entrance, and another from the next point on the west side inside the entrance, and the swirls around them show plainly. In the southern and narrow part of the strait a mid-channel course should be followed.

There is an extensive shoal, or flat, in the northern and widest portion of the strait, lying eastward of the channel and southward of the outlet into Bering Sea. The channel westward of the shoal is said to have a depth of about 2 fathoms. The northern entrance is obstructed by shoals, of a shifting nature, and can be used only by light-draft vessels with local knowledge.

Traders Cove, on the eastern side of Isanotski Strait about 7 miles above its entrance from Ikatan Bay, is a good anchorage. **Morzhovoi,** a mission and native village, is on the south side. Fresh water can be obtained at the southeast corner of the cove near the village. The anchorage is in the middle of the cove off the village, with the Greek church bearing about 111° true (E ¼ S mag.), in 4½ fathoms, muddy bottom. Strong winds and williwaws blow across the cove, but the anchorage is good.

Tides.—The mean rise and fall in Ikatan Bay is 4.5 feet.

In the narrow southern part of Isanotski Strait the tidal currents have a velocity of 7 to 9 miles or more, and it is said that there is practically no slack and that the current turns about three hours after high or low water in Ikatan Bay.

IKATAN PENINSULA,

the southeastern extremity of Unimak Island, is about 13 miles long and is divided into three mountain masses and from Unimak Island by low depressions which extend from West Anchor Cove to East Anchor Cove, and from Dora Harbor and Otter Cove to Ikatan Bay.

Cape Pankof, the eastern end of Ikatan Peninsula, terminates in three cliffs on the southern side, the highest about 1,200 feet, but on the northern side there is a gentle slope to the low isthmus between East and West Anchor Coves. Some bare rocks lie within ¼ mile from the cape, on the southern and eastern sides.

Pankof Breaker lies a little over 2 miles 53° true (NE by N mag.) from the southeast point at the entrance to East Anchor Cove. It is a pinnacle rock, judging from the appearance of the break, with probably less than 10 feet over it and 13 to 25 fathoms close-to.

A rock, said to have about 4 fathoms over it and to break in a southwest swell, is reported to lie about 2 miles 120° true (E by S mag.) from Cape Pankof.

Bird Island, about ½ mile in extent, 750 feet high, and precipitous, lies 2 miles from the south coast of Ikatan Peninsula, off the entrance to Dora Harbor, and 8 miles westward from Cape Pankof. A sunken reef connects the island with the western point at the entrance to Dora Harbor, and there is no safe passage for vessels between. The western end of the island should not be approached closer than ½ mile.

East Anchor Cove, on the north side of Cape Pankof, is a good anchorage except with winds from north to southeast. The cove is large and easily entered, and the only known danger in the approach is Pankof Breaker. **To enter** give the southeast point at the entrance a berth of over ½ mile, and select anchorage as desired in 7 to 10 fathoms. The cove is free from dangers if the shore be given a berth of about ¼ mile.

West Anchor Cove is a safe and commodious anchorage for any kind of vessel, easy of access and departure at any time. The cove is exposed to southerly weather, but with East Anchor Cove on the other side of the cape, safe and sheltered anchorage from any ordinary weather can be found in one or the other. The bottom is fine dark sand in which the anchor holds well. There is a narrow shelf of rocks along the shore at the east point of entrance, the outer edge of which shows at half tide and probably breaks all the time. There is 6 fathoms 70 yards off the visible end of the reef, with rapidly deepening water outward from there. The rock, 15 feet high, inside the cove marks the western limit of dangers on this side. Inside the cove rocky ledges extend not over 200 to 300 yards from the north and south shores. Near the head of the cove, on the southeast side, a rock column stands out prominently from the shore, marking the upper limit of the anchorage for all but small craft.

Dora Harbor, on the south side of Ikatan Peninsula, 2 miles north of Bird Island, affords good anchorage for small vessels, with protection from all winds and swell, especially for vessels of about 9 feet or less draft, which can anchor near the head. The entire shore of the harbor is fringed by ledges, partly bare at low water, to a distance of about 300 yards. The reef extending ¼ mile westward from the eastern point of the entrance and that projecting from the western point toward Bird Island afford protection from ordinary southerly and westerly swell at the outer anchorage, but a heavy swell from southward is uncomfortable. The inner harbor is a slight expansion at the head with depths of 10 to 12 feet in the middle; there is a fishing station and stream on its west side.

To enter Dora Harbor, steer for the west point at the entrance on a 334° true (NW mag.) course, passing ¾ mile northeastward of Bird Island. When the north end of Bird Island bears on the port beam steer 350° true (NNW ½ W mag.). Keep in mid-harbor and anchor with the east point at the entrance bearing 154° true (SE mag.) and the west point 249° true (SW ½ W mag.) in about 5 fathoms. This anchorage is about midway between the east point at the entrance and a projecting point on the west side halfway up the harbor, and the clear width of the anchorage is ¼ mile. Vessels of 9 feet or less draft may follow a mid-harbor course and anchor in the middle of the inner harbor, off the fishing station, in 12 feet of water.

Otter Cove is an open bight at the northwest end of Ikatan Peninsula. It is exposed to southerly winds and to the Pacific swell, and there is always a heavy surf. Northerly winds blow with great violence over the low isthmus separating it from Ikatan Bay. The only safe boat landing is in its eastern corner. A **rock awash** at low water lies over ½ mile from the shore of Ikatan Peninsula and 3½ miles northwestward from Bird Island.

UNIMAK ISLAND, OTTER COVE TO CAPE SARICHEF.

This coast, having a length of about 70 miles, has cliffs in places, with lower land and sand beaches between, and is backed by the high mountain masses of the central part of the island. The coast is fairly regular, with no indentations of any extent, and there are no harbors nor sheltered anchorages. The coast is exposed to the ocean swell, and there is generally a heavy surf, which makes landing dangerous. From the few soundings made, the 10-fathom curve is less than ¾ mile from the beach in most places, and there are no known outlying dangers.

Cape Lazaref is the southwesternmost of three high cliffs, with sand beaches between, which are found in a distance of about 8 miles southwestward of Otter Cove, and is 1,000 feet high. From the sharp point of the cape a reef extends 1⅛ miles southeastward, consisting of two rocks about 150 feet high and another about 70 feet high midway between them, and a multitude of low rocks close together. The outer pinnacle lies 18½ miles 258° true (SW by W ¼ W mag.) from Cape Pankof. Anchorage, with fairly good protection from westerly winds, can be made northeastward of this reef, about ½ mile southward of a bunch of rocks lying ⅜ mile off the eastern side of the cape, in 10 fathoms, sandy bottom. A rocky islet about 130 feet high lies 1½ miles westward of the cape and ⅝ mile from the beach.

From Cape Lazaref the coast trends westward, curving gradually southward for about 30 miles, forming a broad, open bight called **Unimak Bay**, having a sandy beach. This sand beach is broken by a lava bed 8½ miles westward of Cape Lazaref, and by three conical hills, the southernmost reaching the water and formed into several columns, making a small projection (**Rukavitsie Cape**), 15 miles westward of Cape Lazaref. At the southern end of the sand beach there is a broad valley, the south point of which is a sharp projection, with steep sides and about 350 feet high, which forms a small cove (**Promontory Cove**) open northward, which is reported to afford anchorage with protection from southerly winds but not from the swell. The bottom is sandy and the shoaling toward the beach gradual.

Cape Lutke, 2½ miles southward of Promontory Cove, is a cliff 538 feet high, joined by a lower ridge to the higher land farther back, and is the southwestern head of Unimak Bay. At this point the coast changes direction to southwestward and then westward for 13 miles to Seal Cape.

Arch Point, 3 miles northeastward of Seal Cape, is a rocky projection 40 feet high with an arch through the extremity of the point.

Promontory Hill, 5 miles northeastward from Seal Cape, is a short ridge, about 1,130 feet high, having a northwest and southeast

direction, and detached from the interior highland. Its outlines are smoothly rounded and there is a slight saddle in the ridge, the whole having a bare, brown appearance. It is isolated and prominent, and together with Scotch Cap is a good landmark for the eastern entrance to Unimak Pass.

Seal Cape is not particularly noticeable, but the locality is well marked by Promontory Hill, Arch Point, and Scotch Cap.

From Seal Cape around to Cape Sarichef, a distance of 19 miles, the coast of Unimak Island has a number of projecting points, is low in appearance, and slopes gradually upward to the highland of the island. There are low bluffs in places, but none so high as Scotch Cap or which can be mistaken for it. There are no dangers if the coast be given a berth of ½ mile.

Scotch Cap lighthouse is about 1¾ miles eastward of Scotch Cap in approximately latitude 54° 24′ N, longitude 164° 45′ W. The structure is a white, octagonal building and tower, and there are a number of buildings near it. The light is fixed white, third order, elevated 90 feet above high water, and should be visible 15 miles in clear weather when bearing from 277° true (W by S mag.) through north to 108° true (E mag.). The fog signal is a 10-inch compressed-air whistle giving blasts of 5 seconds' duration separated by silent intervals of 55 seconds. Light is discontinued from November 15 to March 20, excepting the last 10 days of each intervening month, during which period the mail boat is expected.

Scotch Cap is a precipitous cliff of rock which extends along the beach nearly 1 mile. It is 420 feet high at its highest point and becomes lower at either end. Back of the face of the cliff the land slopes downward for nearly 1 mile, and then rises by a uniform slope to the higher land of the island. In front of the cliff, 50 yards from its foot, is a large pinnacle rock 172 feet high. Scotch Cap can be seen many miles in clear weather and is unmistakable.

Cape Sarichef, the western end of Unimak Island, is the eastern point at the northwestern entrance to Unimak Pass. The cape is about 100 feet high, with steep grassy sides, and the land back of the cape slopes gradually upward to Pogromni Volcano. There is a black lava bed along the beach south of the cape, and 2 miles south of the cape there is a flat rock barely detached from the coast.

A bank of black sand extends 2.9 miles 267° true (WSW ¼ W mag.) from Cape Sarichef; there are depths of 10 to 15 fathoms over it, and there are heavy tide rips, overfalls, and eddies; the current reaches an estimated force of 2 knots. The banks appear to be an extension in a west-northwesterly direction of the old lava flow which may be seen 1 mile southward of Cape Sarichef lighthouse. No dangerous rocks were found. A reef is reported to extend about ¾ mile from the shore about 1 mile northwestward from the lighthouse.

Cape Sarichef lighthouse, on the summit of the cape, is in approximate latitude 54° 36′ N, longitude 164° 56′ W. The structure is a white, octagonal building and tower, and there are a number of buildings near it. The light is occulting white, light 25 seconds, eclipse 5 seconds, third order, elevated 126½ feet above the water, and should be visible 17½ miles in clear weather when bearing from 16° true (N ⅛ W mag.) through east to 218° true (S by W ¾ W mag.). The fog signal is a first-class, compressed-air siren, giving blasts of 3

seconds' duration separated by alternate silent intervals of 5 and 49 seconds. The light is discontinued from November 15 to March 20 except during the last 10 days of each intervening month, during which period the mail boat is expected.

ALEUTIAN ISLANDS.

This chain extends from Unimak Island to Attu Island, a distance of over 900 miles. The islands fall into various groups, of which the Fox Islands, Islands of the Four Mountains, Andreanof Islands, Rat Islands, and Near Islands are the most important.

The topographic features are uniformly rugged; the islands are mountainous, and the shores bold, with numerous offlying islets, rocks, and reefs. In the absence of surveys, the only safe assumption is that these features are duplicated beneath the surface of the water. At all times in approaching the land, therefore, vessels should be navigated with great caution.

Aside from the lack of surveys, the greatest difficulties in navigating this region are due to a combination of prevailing thick weather and currents which, largely influenced by weather conditions, attain considerable velocity at times. A statement embodying all available information regarding these currents, is given on page 23.

FOX ISLANDS AND PASSES.

The three large islands, Unimak, Unalaska, Umnak, and their associated islands, lying westward of Alaska Peninsula, are known as the **Fox Islands.** The islands of this group are high, bare of trees, and generally grass covered, and terminate generally at the water in precipitous cliffs. Most of them have numerous pinnacle rocks close to the shore. They are frequented by birds in enormous numbers, and immense flocks of them are frequently met with when in their vicinity. The highest peaks which, in clear weather, are prominent landmarks for mariners are:

Round Top Mountain on Unimak Island in latitude 54° 48′ 09″ N and longitude 163° 35′ 35″ W is a rounded summit 6,155 feet high, surrounded by snow fields.

Shishaldin Volcano, on Unimak Island, 9,387 feet high, in latitude 54° 45′ 23″ N and longitude 163° 58′ W, is cone-shaped and very regular in outline, with faint wreaths of smoke and vapor at times drifting from its summit. It is for the most part snow clad, except where the rocky cliffs and projections afford no lodgment.

Isanotski Peaks, on Unimak Island, in latitude 54° 46′ N and longitude 163° 43′ 30″ W, is seen close eastward of Shishaldin, very rugged, and having a broken or castellated double summit, the highest 8,088 feet high. The summit is bare and looks as though composed of great vertical rock masses.

Pogromni Volcano, about 8 miles from the western end of Unimak Island, in latitude 54° 34′ 16″ N and longitude 164° 41′ 30″ W, is 6,500 feet high, a snow clad, conical peak, vertical ridges cropping through the snow. Pogromni is a guiding landmark in clear weather in making Unimak Pass, both from southward and from Bering Sea.

Makushin Volcano, on the northwestern side of Unalaska Island, in latitude 53° 52′ 20″ N and longitude 166° 50′ 40″ W (approxi-

mately), is 5,691 feet high, and in clear weather is a prominent landmark for vessels bound to Dutch Harbor from Bering Sea.

These mountains are excellent landmarks if they can be seen, but in summer they are often obscured by fogs or low-lying clouds. The lower hills and islands and objects near the sea level generally furnish the available landmarks.

From southward and eastward, bound for Bering Sea, there are three passes used by deep-draft vessels, known collectively as the **Fox Islands Passes**, and respectively as Unimak, Akutan, and Unalga Passes. The largest and most desirable one to use in thick and foggy weather is the eastern one, Unimak Pass. This is clear of hidden dangers, the widest of the three, and is comparatively free from tide rips. It is especially recommended for sailing vessels, and for steamers bound northward direct. Akutan and Unalga Passes are convenient, with daylight and clear weather, for steam vessels bound to Unalaska Bay, but, being narrow and having strong currents and tide rips at times, are not recommended for sailing vessels bound north. A fair wind is almost necessary for the passage, and from southward this would bring thick weather. The minor passes between the islands westward of Unimak Pass are described under their several headings following.

Soundings.—Southward of the passes the 100-fathom curve is 20 to 40 miles offshore, and when inside of this depth the color of the water will have changed from dark blue to light green. This change in the color of the water is the best indication the mariner has in thick weather to warn him of his approach to land and that he is on soundings. Southwest of Unimak Pass the 50-fathom curve is 3 to 5 miles offshore, and in thick weather the greatest caution should be used in approaching inside of this depth. Southeast of Unimak Pass the water shoals rapidly from 100 fathoms to Davidson Bank, on which a least depth of 36 fathoms is marked 27 miles from Ugamak Island.

Tidal currents and tide rips.—In the vicinity of the passes the tidal currents have considerable velocity, and their direction and times of change are uncertain; they are also greatly influenced by winds. In navigating near the entrances to the passes the current should be kept in mind and precautions be taken to guard against being carried into dangerous localities, especially in thick weather.

In **Unimak Pass** the observed maximum velocity of the current is about 4 miles per hour, and its velocity is greater near Scotch Cap and Ugamak Island than in the middle of the pass. The northerly (flood) current begins about three hours before the time of high water at Kodiak and the southerly (ebb) current begins about three hours before the time of low water at Kodiak as taken from the Coast and Geodetic Survey Tide Tables. The tide rips, during the largest tides and when a strong wind opposes the current, are strong but not dangerous to well-found sailing vessels or steamers.

In **Akutan Pass** the currents have an estimated maximum velocity of 6 to 7 miles per hour. The northerly (flood) current begins about three hours before the time of high water at Kodiak and the southerly (ebb) current begins about three hours before the time of low water at Kodiak as taken from the Coast and Geodetic Survey Tide Tables. There are strong tide rips during the periods of largest tides; but the strongest rips are not generally found in the middle of the pass.

With a current setting northward the rips will be strongest in the northern entrance from Cape Kalekta and Akutan Island to Unalga Island, and with a current setting southward the strongest rips will be found at the southern entrance to the pass. When the current setting north is opposed by a strong northerly wind the tide rips in the northern entrance to the pass are dangerous, and it is advisable not to use this pass in a gale. Under ordinary conditions, when there are no strong winds, this pass can be used by full-powered steamers at any stage of the current, but sailing vessels should not use it unless they happen to enter at or near slack water. It is stated that the most dangerous rips occur at the north entrance to the pass.

In **Unalga Pass** the currents have an estimated maximum velocity of about 9 miles an hour, and the times for the beginning of flood and ebb currents are the same as for Akutan Pass. The tide rips prevail under the same general conditions as in Akutan Pass, except that they are, if anything, heavier and more dangerous in a gale.

The duration of both flood and ebb is subject to considerable variation in these passes, so that too much reliance should not be placed upon the times given above.

Assistant J. J. Gilbert, commanding Coast and Geodetic Survey steamer "Pathfinder," who surveyed the Fox Islands Passes in 1901, states that "they [tide rips in Akutan and Unalga Passes] occur during spring tides, when the currents are strong, and usually when there is a strong wind or swell from the other direction; this condition is not indispensable, for, on one occasion, there was neither wind nor sea, when suddenly we were in the midst of the rips, and had wet things pretty thoroughly before the hawse pipes could be closed."

When the tide rips are heaviest in Akutan and Unalga Passes, the water is broken into heavy choppy seas from all directions, which board the vessel and make it difficult to keep control even of large, powerful steamers.

The general conditions of **fog** and **weather** described on page 228 apply also to the vicinity of the Fox Islands Passes.

DIRECTIONS, UNIMAK PASS.

Directions from Cape Pankof through Unimak Pass to Cape Kalekta are given on page 152.

In the directions following no allowance has been made for the tidal currents, which have considerable velocity in Unimak Pass; this should be kept in mind in order to make the courses good.

Unimak Pass is the widest of the Fox Islands Passes, being about 10 miles wide at its narrowest part, between Ugamak Island and Scotch Cap. It is free from outlying dangers and dangerous tide rips, and the tidal currents have less velocity than in the other passes. Except near the shores, it is free from williwaws. It is the most desirable pass for sailing vessels and for vessels not calling at Dutch Harbor. The directions for approaching this pass are also good for vessels desiring to pass through Akutan and Unalga Passes.

When approaching the passes from southward and eastward, care must be taken to avoid the Sannak Reefs and Aleks Rock. A good rule is to make longitude 164° W while still south of latitude 54° N

and then stand northwestward to make Seal Cape. If the weather is very clear the mountains of Unimak Island may be seen and recognized and the course shaped for Unimak Pass; but under ordinary conditions Promontory Hill back of Seal Cape, Tigalda Island, or Ugamak Island, will be the first land sighted.

If Tigalda Island is sighted at a distance when approaching Unimak Pass, it will appear as a number of small, detached islands, but when seen closer to it is one island with six distinct mountain ridges.

A 355° true (NNW mag.) course heading for Pogromni Volcano will lead nearly for Seal Cape, passing about 4 miles eastward of Ugamak Island.

If the weather is thick, soundings on Davidson Bank may be of use in feeling the way in to the land. In the vicinity of Seal Cape the coast is bold and may be approached with caution close enough (from ½ to ¾ mile) to be seen and to be followed until some point is recognized by which the vessel's position may be known. A vessel should first be sure of her position before attempting to enter Unimak Pass and in thick weather should not attempt the other passes.

In thick weather, if the land is made in the vicinity of Seal Cape, a vessel may stand westward, following the beach and giving it a berth of ¾ mile or more until Scotch Cap lighthouse or Scotch Cap is made and recognized. With Scotch Cap lighthouse bearing 18° true (N mag.), distant 1 to 2 miles, steer 288° true (W mag.) for 6 miles, and then steer 333° true (NW mag.), which should give the coast of Unimak Island a berth of about 2½ miles, and the course made good for about 11 miles should lead to a position 5 miles 254° true (SW by W mag.) from Cape Sarichef. Or, if bound to Unalaska Bay, when Scotch Cap lighthouse bears 18° true (N mag.), distant 1 to 2 miles, a 266° true (WSW mag.) course made good for 31 miles should lead about 2 miles northward of Akun Head.

In coming from southeastward, when Ugamak Island is sighted shape the course to pass about 2 miles northeastward of it, and then:

From a position 2 miles 63° true (NE mag.) from the northeast end of Ugamak Island make good a 322° true (NW by W mag.) course for 10 miles to a position with Scotch Cap lighthouse bearing 74° true (NE by E mag.), distant 5¼ miles. Then steer 333° true (NW mag.), with the northeastern end of Ugamak Island astern, and give the coast of Unimak Island a berth of about 2½ miles; this course made good for 13½ miles should lead to a position with Cape Sarichef lighthouse bearing 74° true (NE by E mag.), distant 5 miles. Then follow the directions for Bering Sea on page 269.

Or, if bound to Unalaska Bay, from a position 2 miles 18° true (N mag.) of the northeast end of Ugamak Island make good a 280° true (W ¾ S mag.) course for 26 miles, which should lead to a position 2 miles northward of the eastern head at the north end of Akun Island. Then steer 268° true (WSW ¼ W mag.) about 5 miles to a position 2 miles 349° true (NNW ½ W mag.) from Akun Head. Then follow the directions on page 152.

UGAMAK ISLAND,

on the southwest side at the southeast entrance to Unimak Pass, lies 10 miles southward of Unimak Island, and its southeast point is in latitude 54° 13′ N, longitude 164° 46′ W. The island is rugged, with cliffs at the shore, and 1,000 feet high at the eastern end, where there

is a sharp peak. Near the middle of the island there is a knob nearly as high as the eastern end. The island is fringed with kelp and bare rocks close-to, but there are no known outlying dangers. There is no harbor at the island. **Aiktak Island** lies ½ mile southward of Ugamak Island; its south side is a cliff about 600 feet high.

Ugamak Strait, between Ugamak and Aiktak Islands on the north and Kaligagan Island on the south, has a width of 3 miles, and there are no known hidden dangers. Passing 1 mile southward of Aiktak Island, a 290° true (W ¼ N mag.) course, heading for the north end of Akun Island, is considered safe, and carries through the passage in mid-channel.

TIGALDA ISLAND,

the south side of which is in latitude 54° 04′ N, is separated from Ugamak Island by Ugamak Strait. The island is 11 miles long and about 3½ miles wide, and consists of six mountain ridges 1,200 to 1,800 feet high, separated by low valleys having a northwesterly direction. The western end of the island is comparatively low. **Kaligagan Island**, lying in Ugamak Strait ¾ mile off the northeast end of Tigalda Island, is ¾ mile long and about 300 feet high. A large number of high, bare rocks extend 2½ miles westward of Kaligagan Island, and the outermost lies 1¾ miles from Tigalda Island. Two rounded rocks lie ½ mile off the south side of Tigalda Island, and an islet 100 feet high lies close to the island midway between these rocks and the western end of Tigalda Island.

Tigalda Bay, on the north side of Tigalda Island 3 miles from its eastern end, is a sheltered anchorage except from northwest winds. The bay is about ⅝ mile wide and 1½ miles long in a 108° true (E mag.) direction, and has depths of 8 to 10 fathoms, rocky bottom. The mean rise and fall of tides is 0.9 foot.

To enter Tigalda Bay from Ugamak Strait, pass ½ mile or more northward and westward of the outermost bare rock, lying 2½ miles westward of Kaligagan Island, and steer 204° true (S ½ W mag.) for 2¼ miles. Tigalda Bay should then be opened on the port beam. Enter the bay in mid-channel and select anchorage near the middle, taking care not to approach the head nearer than about ⅜ mile.

Approaching from southwestward through Avatanak Strait, follow the north side of Tigalda Island, giving it a berth of about 1 mile until heading about 112° true (E ⅜ S mag.) for the entrance to the bay; on this course Tanginak Islet, about 80 feet high, should be astern and the highest peak (1,400 feet) close to the east end of Tigalda Island should be ahead. Enter the bay and anchor as directed in the preceding paragraph.

Derbin Strait, separating Tigalda and Avatanak Islands, is a little over 1 mile wide, and there are no known hidden dangers. A mid-channel course through the strait, 326° true (NW ½ W mag.), with the northeast headland of Akun Island ahead, is considered safe.

AVATANAK ISLAND,

lying southwestward of Tigalda Island, is separated from Akun Island by Avatanak Strait. The island is about 9 miles long and over 3 miles wide at its eastern end, but the western half of the island averages less than ¾ mile wide. The middle of the island is a great depression

whose sides slope gently upward to the mountains at its eastern and western ends, which are about 1,700 and 1,500 feet high, respectively. Clusters of bare rocks extend about ⅜ mile off the southeast and west ends of the island, and Basalt Rock, about 30 feet high, lies in Avatanak Strait, about 1 mile off the north side of the island. There is no secure anchorage.

Rootok Strait, separating Avatanak Island from Rootok Island, is a little over 1 mile wide in its narrowest part, but the clear channel is reduced by rocks on both sides to a width of about ½ mile; there are no known hidden dangers when passing through in mid-channel. The directions following are considered safe and lead in mid-channel.

Approaching from southeastward, steer for the north end of Rootok Island on a 299° true (W by N mag.) course, leaving the east end of the island ⅝ mile on the port hand. When the west end of Avatanak Island bears abeam, steer about 332° true (NW mag.) and pass in mid-channel between the bare rocks off the west end of Avatanak Island and those close to the north end of Rootok Island.

ROOTOK ISLAND

is the western island on the southeast side of Avatanak Strait, and lies 3 miles southeastward from the southern end of Akun Island. The island is 3 miles long and about 2 miles wide. There are three peaks on its southern side, the highest 1,760 feet, and the island terminates at the shore in cliffs. There is no secure anchorage. The southern ends of Tigalda, Avatanak, and Rootok Islands are nearly in line, bearing 262° true (SW by W ¾ W mag.).

Avatanak Strait is a broad channel separating Avatanak and Rootok islands from Akun Island, and leads from Unimak Pass for Akutan Pass. The strait has a general 245° true (SW ¼ W mag.) direction, and is 3 miles wide at its narrowest part. A few reconnaissance lines of soundings in this channel indicate that the bottom is irregular, but the strait is considered safe by most navigators and its navigation is not difficult in clear weather. Strong northwesterly winds draw heavily through Akun Pass.

Current observations have not been made in Avatanak Strait. The flood current sets northeastward and the ebb southwestward through the strait.

AKUN ISLAND

lies 23 miles southwestward of Unimak Island, and is separated from Akutan Island by Akutan Bay and Akun Strait, and from Rootok and Avatanak Islands by Avatanak Strait. It is about 12 miles long, but is very irregular in shape, being nearly divided by Akun Cove and Lost Harbor and a low depression joining them. The island is high and rugged, particularly its northern part, which reaches an elevation of about 2,500 feet in an extinct crater at its northwest end on the north side of Lost Harbor. The northern end of Akun Island is two massive heads about 4 miles apart, separated by Little Bay with a moderately low divide at its head, the whole forming a large valley. Both heads have precipitous sea faces about 1,200 feet high, and have grassy saddles southward of them. **Akun Head**, the western headland, has a long lozenge-shaped horizontal strata with a red iron-rust color in the face of the cliff. **Tanginak Islet**, about 80 feet

high with steep sides, lies 2¼ miles off the east end of Akun Island, and there is a deep passage between if the east end of Akun Island be given a berth of over ⅝ mile. **Tangik** and **Poa** Islands (about 200 feet high) lie in Avatanak Strait about ¾ mile off the southern side of Akun Island. Two low islets surrounded by kelp lie on the eastern side at the northern end of Akun Strait close to the southwest end of Akun Island. There are a number of anchorages around the island with offshore winds. The best are—

Seredka Bay, on the south side of Akun Island 2 miles westward of Round Head, the southeast point of the island, and 1½ miles northward of Tangik Island, is about 1 mile wide and the same long, open southeast, and has two bights at the head. The bay is easy of access, and a safe and roomy anchorage except with southeast winds. There is considerable kelp on the southwest side of the bay. The *Pathfinder* anchored in the bight at the north end of the bay, with the east end of Tangik Island shut out by the south point at the entrance to the bay.

Akun Cove is the broad indentation in the northeast side of Akun Island; it affords anchorage at its head except with winds from southeast to northwest, but heavy williwaws are experienced with offshore winds. The bay is 5 miles wide at its entrance and about 4 miles long. At its head, where the bay is 2½ miles wide, there are two large bights. Anchorage may be made in either of the bights, about ½ mile from shore, in 10 to 15 fathoms. There are no known dangers in the bay except close to shore. There are fresh-water lakes at the heads of the bights, about 10 feet above high water, and there is a very low depression from the head of the northern bight to Lost Harbor.

Lost Harbor has its entrance from Akutan Bay on the western side of Akun Island about 6 miles southward of Akun Head. It is a good harbor, sheltered from all except southwest winds, and is large and easily entered. The harbor has a uniform width of 1½ miles and is nearly 3 miles long in a 63° true (NE mag.) direction.

Approaching Lost Harbor from westward pass about 1 mile northward of North Head (of Akutan Island) and make good a 102° true (E ½ N mag.) course for 10 miles, which should lead to the middle of the entrance. Then steer about 57° true (NE ½ N mag.), following a mid-channel course into the harbor, and taking care to give the northwest shore of the harbor a berth of ⅝ mile or more until near the head. When about ¾ mile from the head of the harbor haul up to about 332° true (NW mag.) and anchor about ½ mile from shore at the northwest end of the head of the harbor, in about 10 fathoms.

Approaching from northward around Akun Head, follow the western shore of Akun Island at a distance of about 1 mile until in the middle of the entrance to Lost Harbor, and then proceed as directed in the preceding paragraph to the anchorage.

AKUTAN ISLAND,

the largest between Unalaska Island and Unimak Pass, is about 15 miles long in a general east and west direction, and its greatest width in a north and south direction is about 10 miles. The island lies about 9 miles northeastward from Unalaska Island and is separated

from the latter by Akutan and Unalga Passes. **Akutan Peak**, 4,100 feet high, is a little west of the middle of the island and is its highest point. On the northeast side the island is separated from Akun Island by Akutan Bay and **Akun Strait**; the latter is about ¾ mile wide, but the ledges on both sides leave a channel about 600 yards wide at its narrowest part, with a depth of about 7 fathoms. There are strong tide rips in this channel, and it is not recommended. As far as known there are no dangers over ½ mile from the shore of the island, except the reef on its northwest side.

North Head is a high, bold cliff, with a large, deep, grassy valley in the otherwise high shore on its east side. About 2 miles southwestward of the cape there is a narrow, grassy valley which separates the high ridge of North Head from another high ridge; the western side of the valley is a bluff.

Lava Point, 6 miles southwestward of North Head, is moderately low lava beds. At the end of the point is a flat rock having the same height as the point and slightly detached from it.

A reef, bare at low water and covered with kelp, extends ⅞ mile from the western side of Akutan Island at a point 2½ miles southward of Lava Point.

Cape Morgan, the southwest end of the island and on the north side of Akutan Pass, is steep and high. Three pinnacle rocks, 4 to 8 feet high, lie in the pass 600 yards off the cape, and other bare rocks extend the same distance off its southeast side. The cape should be given a berth of over ½ mile.

Battery Point, the south end of Akutan Island, is prominent, steep, and high, and is surrounded by bare rocks close-to.

There are a number of places where vessels may anchor with an offshore wind; but they are open seaward and are not recommended. Akutan Harbor is the only secure anchorage.

Vulcan Cove, about 3 miles northeastward of Battery Point, affords shelter in northerly weather, but is open to the Pacific swell.

Hotsprings Bay is a wide indentation in Akutan Island open northward between North Head and Akutan Harbor. The north point at the entrance is a high, rocky cliff. The south point at the entrance, **Ridge Point**, lying about 2½ miles southeastward from the north point at the entrance, is a narrow ridge about 150 feet high, which has bare rock cliffs on its west side, but slopes rapidly on its east side into a grassy valley and sandy cove. At the head of the bay are three bights having streams, and the southernmost has hot springs about 1 mile up the stream. No directions can be given for anchoring in the bay, except that the anchorage is reported to be in 15 to 20 fathoms, sandy bottom. A kelp patch extends a short distance into the bay from the south point at the entrance.

Akutan Harbor is on the north side of the island near its eastern end. The harbor is entered from northward through Akutan Bay; it is nearly 3¾ miles long and ½ to 1¾ miles wide. There are no known dangers over 300 yards from the shore. There is anchorage off the the north shore abreast an Aleut village about 1⅝ miles westward of the north point at the entrance and about 300 yards from the shore in about 22 fathoms. A vessel may also anchor in the broad bight in the south shore in 15 fathoms, with the north point at the entrance bearing about 17° true (N mag.) and taking care to keep clear of the

kelp. A light is established on the southeastern end of the point on the north side of the entrance.

There is a whaling station in Akutan Harbor, from which steam whalers are operated. In 1913 and 1914 a considerable supply of fuel oil was on hand at the station, and vessels were supplied when notice was given in advance.

Approaching Akutan Harbor from Akun Head, follow the northwest shore of Akun Island giving it a berth of about 1 mile until abreast the old crater on the island, and then steer about 178° true (S by E ¾ E mag.) with Akun Strait on the port bow. The north point at the entrance to Akutan Harbor will be a little on the starboard bow (this point is a grassy hummock over 100 feet high and is connected with the mainland of Akutan Island by a low, grassy spit). Steer so as to leave this point over ¼ mile on the starboard hand, round it at this distance, and then steer 251° true (SW ¾ W mag.) into the harbor, giving the shores a berth of over 300 yards. Anchor off the village, taking care to allow the vessel swinging room.

Passing north of North Head (of Akutan Island) leave it about 1 mile on the starboard hand and steer about 107° true (E mag.), giving the shore of the island a berth of 1 mile on the starboard hand. Having stood on this course about 6 miles and when Ridge Point bears on the starboard beam distant 2 miles, steer 150° true (SE ¼ E mag.) about 4 miles; the north point at the entrance to Akutan Harbor should then be forward of the starboard beam distant nearly ¾ mile; steer so as to leave the point over ¼ mile on the starboard hand and enter the harbor as directed in the preceding paragraph.

AKUTAN PASS

is 2½ miles wide in its narrowest part. There are six small islets, Baby Islands, on the western side of the pass, with many detached rocks above water in the same group, but not extending beyond the islets into the pass. **Cape Morgan,** on the north side of the pass, should be given a berth of over ½ mile. The breaker reported in the middle of Akutan Pass was searched for and does not exist. The current and tide rips (see p. 197) are not so strong as in Unalga Pass. On this account, and because of its greater width and the fact that a straight course will carry through, this pass is preferred by many to Unalga Pass.

Akutan Pass is recommended, in the daytime with clear weather, for steamers bound to or from Unalaska Bay, and for sailing vessels from Unalaska Bay with a fair wind. From southward it is recommended to make the land in the vicinity of Tigalda Island and Avatanak Island and follow along the south side of these islands until the course is shaped from Rootok Island to Cape Morgan. A mid-channel course through the pass is recommended as the most prudent one.

DIRECTIONS, AKUTAN PASS.

From a position 3 miles southward of Rootok Island a course 280° true (W ⅝ S mag.) made good for 17 miles will lead 1⅝ miles southward of Battery Point and to a mid-channel position in the pass between Cape Morgan and Baby Islands. Continue the course 3 miles past Cape Morgan to a position 2 miles off the north side of

Unalga Island, and then steer 269° true (WSW ⅜ W mag.) with Battery Point astern. This course made good for 8 miles will lead to a position 1¼ miles northward of Cape Kalekta.

UNALGA ISLAND

lies northeastward of Unalaska Island nearly halfway to Akutan Island; Akutan Pass leads between Unalga Island and Akutan Island, and Unalga Pass leads between Unalga Island and Unalaska Island. Unalga Island is about 4½ miles long east and west, about 2½ miles wide and 650 feet high, covered with high grass. Lying north of the eastern end of the island is a group of six small islands known as **Baby Islands**; between these and Unalga Island there is a kelp-bordered passage (**Baby Pass**) about ¾ mile wide with a reported depth of 11 fathoms. The southern and western shores of Unalga Island bordering on Unalga Pass are free from outlying dangers; but it is advisable to give them a berth of at least ½ mile.

Malga Bay, also called Unalga Cove, on the northwest side of Unalga Island, is about ⅝ mile in diameter and affords shelter in southerly weather. No directions are necessary except to keep in the middle of the cove and well clear of the kelp. The mean rise and fall of the tides is 1.2 feet.

UNALGA PASS,

between Unalga and Unalaska Islands, is the narrowest of the three principally used passes, and has the strongest tidal currents. It is about 1¼ miles wide in its narrowest part, and, with the exception of rocks above water, which make out a short distance from the points of Unalaska and Unalga Islands the pass is considered free from dangers. In the middle of the pass there are depths of 24 to 40 fathoms, with deeper water northwestward and southeastward. Its worst features are the strong tidal currents and tide rips, both of which are generally considered worse in this pass than in either of the other two; williwaws of great force are also experienced. The advantage of using this pass in thick weather is that the shore of Unalga Island is clear of outlying dangers, and when made can be followed close enough to keep it in sight while going through.

The Signals, Egg Island, and Old Man are the prominent landmarks for making Unalga Pass from southeastward.

For currents and tide rips in the pass, see page 198.

DIRECTIONS, UNALGA PASS.

From Southeastward.—Passing 3 miles southward of Rootok Island a course 261° true (SW by W ¾ W mag.) made good for about 20 miles will lead to a position 2 miles off the south side of Unalga Island. Then steer about 292° true (W ½ N mag.) to a position about ¾ mile off the southwest end of Unalga Island in the narrowest part of the pass.

Or, when Egg Island is recognized, pass 2 to 3 miles northward of it, about midway between it and Unalga Island, and steer about 292° true (W ½ N mag.) to a position about ¾ mile off the southwest end of Unalga Island in the narrowest part of the pass.

From a position about ¾ mile off the southwest end of Unalga Island make good a 329° true (NW ¼ W mag.) course for 3 miles to a position with Erskine Point 1 mile on the port beam. Then steer 297° true (W ⅞ N mag.) for 4 miles and pass 1 mile northward of Cape Kalekta.

The above directions lead through the middle of the pass, and this is the safest course for any vessel to follow on account of the tide rips and strength of the current. The shore of Unalga Island, bordering Unalga Pass, as far as known, is free from dangers at a distance of ¼ mile from shore. On the southern side of the pass there are some rocks showing out of water, but not over ¼ mile from the shore.

UNALASKA ISLAND,

lying southwestward of Akutan Island and separated from the latter by Akutan and Unalga Passes, is one of the three largest of the Aleutian Islands. The island is about 67 miles long, about 23 miles wide at its widest part, mountainous, and during the greater part of the year the mountains are covered with snow. **Makushin Volcano,** 5,691 feet high, the highest point on the island, is near its northwestern side about 25 miles from the eastern end of the island. The eastern end of Unalaska Island was surveyed in 1901, but the island west of Biorka Island and Unalaska Bay is still imperfectly known.

Biorka Island, close to the northeastern end of Unalaska Island and separated from the latter by a narrow, deep strait (Udagak Strait), appears as a part of Unalaska Island. A number of rocks lie 1 to 2¾ miles eastward of the eastern end of Biorka Island.

Egg Island is about ¾ mile in diameter, 550 feet high, and lies about 1½ miles northeastward from the north point of Biorka Island. Lying a little over ¾ mile west of Egg Island are **Old Man Rocks,** two rocks surrounded by deep water; the higher is about 60 feet high and flat-topped, and the smaller is round-topped and lies a short distance north of the higher rock.

Egg Island Passage leads between Egg Island and Biorka Cape and southward of Old Man Rocks. This pass is nearly 1½ miles wide and has a depth of about 35 fathoms in the middle. A 309° true (WNW mag.) course passing midway between Egg Island and Biorka Cape leads through the middle of the pass.

The Signals are three small rocks. The outer is 50 feet high and lies nearly 3 miles southward from Egg Island. A small rock, 10 feet high and over which the sea washes, lies a little over ¼ mile eastward of the **Outer Signal.** The **Inner Signal** is 180 feet high and lies ⅞ mile from the shore of Biorka Island and 4½ miles south of Egg Island. There is apparently deep water between the Inner Signal and Outer Signal, but they should be approached with caution.

BEAVER INLET

makes in 17 miles in a 235° true (SW ⅝ S mag.) direction in the northeastern end of Unalaska Island. Its entrance lies between Biorka Cape on the southeast and **Brundage Head** on the northwest and is approached from southward and eastward between Egg and Unalga Islands. The least width of the inlet is 1⅝ miles near its head and it has a clear and unobstructed channel its full length.

Udagak Strait separates Biorka Island from Unalaska Island; its entrance in Beaver Inlet is 9¾ miles southwestward from Old Man. This strait has a least width of ¼ mile, but has good water; there are some rocks off the south spit of the narrows which mark three points of a reef the limits of which are marked by kelp; one or more of the rocks are always visible. To pass through the strait follow a mid-channel track, giving the two gravel spits a good berth. There is an anchorage, sheltered from all winds, in **Udagak Bay**, an indentation in the west shore of the strait about 3¼ miles from its entrance in Beaver Inlet.

There are a number of bays making off from Beaver Inlet in which vessels may anchor, but those on the south side of the inlet are open northward and northwestward and those on the north side are open southward and eastward.

Udamat Bay, on the northwest side of Biorka Island, 5½ miles southwestward from Old Man, extends 2¾ miles in a 186° true (S by E mag.) direction, has a general width of ¾ mile near its head, and has a deep and unobstructed channel. There is a small native village on the north side of the point at the east side of the entrance to the bay. Vessels may anchor in the southeastern end of the bay, taking care to have room to swing.

Strait Bay makes into Biorka Island from Beaver Inlet just east of Udagak Strait; the *Pathfinder* anchored in the head of this bay.

Amugul Bay makes southward from Beaver Inlet about 3 miles southwestward of the entrance to Udagak Strait. The *Pathfinder* anchored in a cove in the southwestern and broadest part of the bay. There is a small island on the eastern side of the entrance to the bay.

At the head of Beaver Inlet there are four small bays; named in order, following the south shore around to the north shore, they are **Tanaskan, Final, Kisselen,** and **Erskine.** The *Pathfinder* anchored near the head in Final and Erskine Bays.

Uniktali Bay makes into the north shore of Beaver Inlet about 15 miles above its entrance; this bay is nearly 3 miles long in a westerly direction and ¼ mile wide at its narrowest part near its head.

Agamgik Bay and **Ugadaga Bay** are two indentations in the north shore of Beaver Inlet 5½ and 8 miles, respectively, above the entrance of the inlet. From the head of Ugadaga Bay a trail leads to the village of Iliuliuk. There are rocks off the western point at the entrance to Agamgik Bay.

Deep Bay is the bight on the north side of the entrance to Beaver Inlet, and is protected from northeastward by a long ledge and several small islets which make off about ½ mile from the shore. The *Pathfinder* anchored in the northwestern corner of the bay.

The places in Beaver Inlet where the *Pathfinder* anchored were used only as anchorages for the night while that vessel was engaged in surveying in the locality.

ENGLISH BAY

is a secure anchorage in the north side of Unalaska Island, directly south of the west end of Unalga Island. The best anchorage is nearly 2 miles above the entrance in about 6 or 7 fathoms; the width of the anchorage between the 5-fathom curves is here about 300

yards. There are bare rocks off both points at the entrance, between which the channel has a width of about ⅜ mile. When about 1¼ miles above the entrance the western shore should be given a berth of over 400 yards to avoid a shoal with 1 to 3 fathoms over it which stretches along the shore ½ mile. **In entering** care must be taken not to be set off the course by the strong currents in Unalga Pass, which have a maximum velocity of about 9 miles; follow a mid-channel track or favor the eastern shore and anchor in 6 to 7 fathoms in the middle of the bay nearly 2 miles above the entrance. Good holding ground in depths of 12 to 17 fathoms will be found ¾ to 1½ miles inside the entrance. There is a small fishing village on the eastern point (**Fisherman Point**) at the entrance to the bay. From Fisherman Point eastward a little over 1 mile to **Brundage Head** there are ledges and rocks which lie some distance from the shore.

KALEKTA BAY

is a broad, open bay in the north end of Unalaska Island just east of Unalaska Bay; it has no known dangers over 400 yards from the shore, and there are a number of places where a vessel may anchor; but as this bay is open northward, and English Bay and Dutch Harbor are better harbors, it is not recommended. There is a pinnacle rock off Erskine Point, the eastern point at the entrance, somewhat similar to Priest Rock; but this rock is distinguished by a smaller one between it and Erskine Point.

UNALASKA BAY

is the indentation making into the north end of Unalaska Island between Cape Kalekta and Cape Cheerful. Commercially it is one of the most important bays in western Alaska. Its shores are generally mountainous, with precipitous sea faces. **Amaknak Island** lies in its southern end. Westward of the island the water is deep, but there is no good harbor in this part of the bay; eastward of the island are the important anchorages of Iliuliuk Bay, Dutch Harbor, and Iliuliuk Harbor. The channel to Iliuliuk Bay and Dutch Harbor is free from dangers, except along the shores. Iliuliuk Harbor is obstructed at its entrance by ledges, but with the aid of the buoys is not difficult to enter with a small vessel.

Cape Kalekta, 500 feet high, is the eastern point at the entrance to Unalaska Bay. The extremity and western side of the cape are rugged, precipitous cliffs, with a few rocks but no beach at the water line. From the summit of the cape the land falls to the break at Constantine Bay, and then rises to higher land farther south. A dangerous ledge, usually marked by breakers, lies nearly ⅜ mile northward of the cape. The cape should be given a berth of 1 mile or more to clear the ledge, as the strong tidal currents may tend to carry a vessel on it.

Priest Rock, close-to off the northwest side of Cape Kalekta, is a pinnacle about 175 feet high. A portion of the northwestern face of the rock has been whitewashed to aid in its identification.

Cape Cheerful, the western point at the entrance to Unalaska Bay, is made up of bold, very high headlands, rounded on top, and intersected by deep, grassy valleys. The shore is free from dangers and has deep water close-to. A cascade, 125 feet high, south of Cape Cheerful, can be seen from the vicinity of Cape Kalekta, and is some-

times useful in thick weather, when only the lower part of the land can be seen.

Ulakta Head, the north end of Amaknak Island, is 900 feet high. It has a flat top, and in clear weather it is one of the best landmarks for fixing the position of Unalaska Bay. From its northwest point a reef extends ⅛ mile, marked by Needle Rock, similar in appearance to Priest Rock, but not so large. From its northeast point a long, narrow, grassy, shingle spit extends southward 1⅛ miles; its southern end, called Spithead, is marked by a black and white wooden beacon which is liable to be destroyed by heavy gales. An extensive reef with little depth over it is reported to lie between Amaknak Island and Hog Island.

Princes Head, 2 miles from Cape Kalekta, is a large, square-headed rocky point that projects from the shore far enough to be seen, even in thick weather, when following the east shore.

Constantine Bay, about 4 miles from Cape Kalekta, is obstructed by numerous ledges, many of which are only evident from the attached kelp. It is of no importance and should be avoided by all vessels.

Summer Bay, the large, shallow bight 3 miles from Constantine Bay and opposite Ulakta Head, is shoal, and its shores are lined with kelp-marked rocks and ledges. At its southern headland is Second Priest, about 60 feet high. The bay should be avoided by vessels.

Iliuliuk Bay extends from Second Priest and Ulakta Head to Iliuliuk. Northward of Spithead there is a ridge extending across the bay, on which the least depths found are 7 to 8 fathoms; kelp has been seen on this ridge in about mid-channel. South of this ridge the depths increase to 16 and 19 fathoms. There is anchorage anywhere in the bay. The usual anchorage is at the head in 14 to 16 fathoms, muddy bottom, where, even with northerly winds, the force of the sea does not seem to reach home. At the head of Iliuliuk Bay, behind the village, there is a ravine or break in the mountains, which extends through to the water southward. This is sometimes useful as a guide in entering the bay.

DUTCH HARBOR (CHART 9008)

is on the west side of Iliuliuk Bay. Its entrance is between Spithead and Rocky Point. The water is deep close to the shores and in all parts of the harbor, except off Rocky Point, where there is a reef making off a little less than ¼ mile, marked at its end by a black can buoy. The entrance between Spithead and the end of the reef off Rocky Point is about ½ mile wide, with a depth of 18 fathoms. Anchorage may be had throughout the harbor in 14 to 19 fathoms. Violent williwaws are experienced during gales, especially from southwest, and the best shelter will be found under the high part of the island well northward of the wharf.

The headquarters of the North American Commercial Co. for this part of Alaska are situated on the south side of Dutch Harbor. In front of their warehouses and coal depot a T-shaped wharf extends out to deep water. Large vessels can lie at the outer end, and there is ample room for small vessels on the inside of the T. The wharf is old and weak; a large vessel should lay out anchors to hold her clear in bad weather. Fresh water can be obtained at the wharf. A naval radio station is operated at Dutch Harbor.

ILIULIUK HARBOR (CHART 9008)

is joined to the head of Iliuliuk Bay by the passage between Iliuliuk Reef and the village of Iliuliuk (Unalaska post office). The harbor is small and the channel leading into it narrow, and it is suitable only for small or moderate-sized vessels, although vessels of 6,000 tons have been taken in and out.

Channels.—The channel always used is the one southward of Iliuliuk Reef. A red buoy marks the southern end of Iliuliuk Reef and a black buoy approximately the 3-fathom curve on the opposite side of the channel. The passage has a least depth of about 5 fathoms at mean lower low water, and a clear width of about 27 yards between Tuscarora Rock and the 19-foot shoal spot on the north side of the channel. It should be noted that Tuscarora Rock is charted about mid-channel between the buoys.

There is a channel northwestward of Iliuliuk Reef, between it and North Rock, which has a least found depth of 3 fathoms, but it should not be attempted except with local knowledge.

Anchorage.—Iliuliuk Harbor is small, but landlocked, with good holding ground, and an average depth of 10 fathoms. Violent williwaws are experienced with strong southwest gales. The headquarters of the Alaska Commercial Co. are at Iliuliuk, and the company has a wharf projecting into the harbor at its entrance from the western end of the spit on which the village is located, with depths of 4¼ to 6 fathoms along its north and west faces.

Iliuliuk is the original Russian settlement. There is a Greek church with a parochial school, also a Methodist mission school. The post office, United States deputy collector, United States commissioner, and United States deputy marshal for this general locality are located here. The post office is called **Unalaska.**

Supplies, etc.—The Alaska Commercial Co. has a well-stocked general store and commodious warehouses at Iliuliuk. Coal is kept on hand for sale and can be handled at the rate of 200 tons per day. Fresh water can be obtained at the wharf. Lumber can usually be obtained in limited quantities.

Tides.—The mean rise and fall in Dutch Harbor is 2 feet. The tidal current in Dutch Harbor is inappreciable, and in Iliuliuk Harbor the velocity does not exceed 1 knot.

Ice.—The bay is open to navigation at all seasons. It is reported that on two occasions the drift ice of Bering Sea entered Unalaska Bay, but such an occurrence is so rare that it need not be considered. Ice often forms in the sheltered coves and harbors in cold, calm weather, but it never attains any thickness or interferes with navigation.

The remaining portions of **Unalaska Bay southward and westward of Amaknak Island** are not important to navigators, but may be briefly described as follows: The portion south-southwestward of Amaknak Island is a long narrow inlet called **Captains Bay**; it has not been accurately surveyed, but vessels have entered it on occasions. The narrow passage from it to Iliuliuk Harbor is not recommended. There are a few houses along the eastern shore, and a ranch at the head of the bay. On the western side of Unalaska Bay are **Nateekin Bay, Broad Bay**, and **Eider Point Anchorage**, none of which are of any importance. This coast is high, with valleys at the heads of the bays,

and several conspicuous waterfalls over the cliffs between them. **Hog Island** lies off the western side of Amaknak Island; rocks and reefs have been reported all round it extending to a considerable distance, and the locality between it and Amaknak Island is reported foul right across. A long reef is charted, extending south-southeast from Eider Point.

DIRECTIONS, UNALASKA BAY.

When bound for Unalaska Bay from any part of Bering Sea, it is recommended to shape the course for Cape Cheerful. In thick weather it is better to fall westward of Cape Cheerful and then round it than to fall eastward of it and get down into the passes. **Makushin Volcano,** 5,691 feet high, can generally be seen in clear weather, and is prominent. An extinct **crater,** 2,314 feet high, back of Cape Cheerful and west of Eider Point, gives a distinct point for which to steer until close enough to distinguish the surrounding features. On getting close to the island, when the fog hangs over the land but leaves a clear space just along the water's edge, **Wislow Island** forms a good mark. It is in a small bay about 2 miles westward of Cape Cheerful, and is a small, rounded island, regular in shape, and stands far enough from the land to be seen as not a part of the main island. Westward, under similar conditions, **Makushin Cape** can be seen at times. The land slopes gently to the cape from Makushin Volcano, and ends in a small peak-like formation. From eastward the **cascade** south of Cape Cheerful is also useful as a mark. Strangers, when in the vicinity and uncertain of the identity of the bay and its landmarks, should endeavor to pick out **Ulakta Head.** Looking into the bay, its flat top breaking off abruptly to sloping sides presents an appearance unlike any other in the vicinity, and shows up well against the background of mountains. When sighted, steer for it, leave it on the starboard hand, and follow around, keeping out of kelp.

Cape Kalekta to anchorage.—Having arrived in the vicinity of Cape Kalekta, give it a berth of over 1 mile in rounding it, and steer for Ulakta Head, course 214° true (S by W ½ W mag.), about 4 miles. When the south point at the entrance to Constantine Bay is abeam, distant 1 mile, change course to 195° true (S ¼ E mag.) for about 3½ miles to a mid-channel position in Iliuliuk Bay eastward of Ulakta Head. Then follow a mid-channel course through Iliuliuk Bay, course about 220° true (SSW mag.), and anchor ¼ to ½ mile from the head of the bay in 14 to 16 fathoms, muddy bottom.

To enter Dutch Harbor pass between Spithead and the buoy off Rocky Point, and anchor in the harbor, as desired, in about 18 fathoms, muddy bottom.

At night the spit is difficult to make out, and the following may be useful: Stand through Iliuliuk Bay in mid-channel, taking care to keep clear of the reef on the eastern side of the spit, and when the lowest part of Amaknak Island, at the southwest end of Dutch Harbor, bears 276° true (W by S mag.) steer for it, keeping the bearing, which leads in mid-channel between Spithead and Rocky Point buoy. On this course the high mountain on the eastern side, south of Summer Bay, should be directly astern.

To enter Iliuliuk Harbor, stand southward through Iliuliuk Bay on the 220° true (SSW mag.) course until the buoys are sighted. Then haul westward and in passing between the buoys, favor the

red buoy, keeping out of the kelp. Iliuliuk Reef is marked by kelp, which with care, serves as a guide if the buoy is not in place. When clear of Tuscarora Rock haul northward to pass in mid-channel southward of the dry rocks of Iliuliuk Reef and pass close to the northeast corner of the wharf. Small vessels may anchor in the middle of the harbor in 10 fathoms; the western side of the harbor should be given a berth of over 100 yards.

Remarks.—Sailing vessels entering Dutch Harbor should carry sufficient sail to keep good way on until past the beacon on Spithead. It has frequently occurred that vessels shortening sail at Ulakta Head have been set toward the shoal on the east side of the spit owing to little headway and the wind drawing ahead. They are then obliged to anchor in an exposed place, and steam assistance is not always available.

The 214° true (S by W ½ W mag.) course from Cape Kalekta follows the shore northward of Constantine Bay at a distance of about 1 mile. In thick weather, when following the east shore, care must be taken not to enter Constantine or Summer Bays by mistake. This has sometimes occurred when the opposite headland could not be made out. If passing southward of Tuscarora Rock, vessels are obliged to make a sharp turn westward, and care should be observed.

Dangers.—A large cluster of rocks, mostly awash, and usually marked by breakers, extends nearly 200 yards westward of the south head of **Constantine Bay.**

Second Priest, near the south point of Summer Bay, is surrounded by reefs, awash and under water, for a distance of 300 yards. Between Second Priest and a point opposite the entrance to Dutch Harbor the east shore is fringed with rocks, and should not be approached closer than ¼ mile.

The **spit** has a kelp-marked shoal on its east side which extends its whole length; at its middle point the shoal extends ¼ mile from shore, and from it a ridge on which the least depth found is 7 fathoms, extends east-southeastward across the bay. Kelp has been seen on this ridge about in mid-channel. Spithead is bold-to, and may be safely approached as close as 150 yards.

Rocky Point has a kelp-marked reef which extends toward Spithead about 350 yards; eastward of the point the shoal makes out about 200 yards with little kelp. The northeastern extremity of the reef is marked by a buoy (can, black, No. 1) in 7 fathoms.

From Rocky Point south, the shore of Amaknak Island should not be approached closer than 300 yards.

Iliuliuk Reef is a ledge, portions of which are always exposed, extending 250 yards in an east and west direction. From the eastern dry rocks a ledge, with 12 to 15 feet over it and marked by kelp, extends 150 yards 177° true (S by E ¾ E mag.).

Tuscarora Rock is charted as a 3-fathom spot of small extent, with some kelp, lying 213 yards 172° true (SSE ⅛ E mag.) from the easterly dry rocks on Iliuliuk Reef. The 3-fathom curve, on the edge of the shoal making out from the shore, is about 35 yards southward of Tuscarora Rock.

A dangerous rock, having 15 feet over it at mean lower low water, was found in 1915 in the channel between Iliuliuk Bay and Iliuliuk Harbor. The rock lies in the southern part of the channel, 172 yards 54° true (NE ⅝ N mag.) from the higher and larger of the two spires on the Russian church at Iliuliuk, and 502 yards 132° true (SE by E ¾ E mag.) from the northeasterly corner of the Alaska Commercial Co.'s wharf.

A rocky and sandy shoal spot with 19 feet over it at mean lower low water was also found in 1915 near the northern limits of the channel between Iliuliuk Bay and Iliuliuk Harbor, 221 yards 46° true (NNE ⅝ E mag.) from the larger and higher of the two spires on the Russian church at Iliuliuk, and 487 yards 126° true (ESE ¼ E mag.) from the northeasterly end of the Alaska Commercial Co.'s wharf.

NORTH COAST OF UNALASKA ISLAND.

There are no available surveys of the Aleutian Islands west of Unalaska Bay. The charts are compilations from various sources, with corrections made from later information received; they are therefore necessarily imperfect, and must be used with caution, especially in the vicinity of the land.

Cape Cheerful is described on page 208, and Wislow Island on page 210.

Irishmans Hat is a square tower rock about 50 feet high lying close to shore about 3 miles westward of Wislow Island.

Makushin Cape, 13 miles southwestward of Wislow Island, is a round hill 400 feet high, which appears like an island from a distance, and is a good mark. There are a number of prominent pinnacle rocks off the cape. Southward of it is **Cape Kovrizhka**, also called Cape Gattan, and **Volcano Bay.**

Makushin Bay has an Aleut village, and there are promising mineral prospects in the vicinity. The northern entrance point is marked by a rocky islet about 40 feet high, lying 1½ miles southwestward of the point; there are several rocks above water between it and the shore. **To enter the bay**, pass about 1 mile westward of the rocky islet, and when it is abeam, steer 151° true (SE mag.) iuntil some remarkable pinnacle rocks are in line with a low dip In the mountains at the head of the bay, bearing about 96° true (E ⅞ N mag.). Then steer for them through the middle of the entrance until Priest Rock and the village open out on the port hand; haul in for the village on bearing 286° true (W mag.) and anchor in 13 fathoms, mud bottom, with the church bearing 286° true (W mag.) and Priest Rock bearing 230° true (SW by S mag.). Soundings in this harbor showed no dangers. Fresh water is obtainable near by.

Kashega Bay is charted 14 miles south-southwestward of Makushin Bay. The following information was furnished by the Coast Guard Cutter *Manning:*

When clear of Cape Spray haul to pass 3 miles off Kashega Point. A high conical rock will be seen bearing a little on the port bow and apparently well over toward the western side of Kashega Bay. Keep this rock a little open on the port bow until Kashega Point is abeam, then haul to 139° true (SE by E mag.) with the conical rock open on the starboard bow, heading for a mid-channel position between the grassy island and the north entrance point of the inner harbor.

When the village is first sighted on this course it is seen directly under a conical mountain peak. Continuing on this course, the village shuts in behind a low bluff and the harbor opens. With the harbor open, steer a mid-channel course for a short distance inside the grassy island, and anchor in 9 fathoms, hard bottom.

Chernofski Harbor (chart 9196) is charted about 22 miles southwestward from Makushin Bay, and near the northeast entrance to Umnak Pass. It is reported to be a safe harbor, sheltered from all weather. Approaching it from northward, a vessel first makes **Nellie Juan Cape**, a high bold bluff, unlike any other land in the vicinity. There is a reef about 300 yards long extending off the cape; the reef ending in a rock about 15 feet high.

From Nellie Juan Cape continue for about 3½ miles to **East Point**, opening out Chernofski Church over the land to the right of a high wedge-shaped rock about 1 mile eastward of the entrance. The entrance is between East and West Points, through a narrow canal formed by low promontories. The seaward faces of the points are rugged and broken, and there are rocks extending seaward on the line of the ridges off both points; there is a deep wide cleft across the middle of the eastern promontory, which forms a landmark when bearing southward of southeast. The inner harbor is reported to be ¼ to ⅜ mile across. From the entrance, the right tangent of Umnak Island bears 309° true (WNW mag.).

To enter, round East Point not less than 500 yards distant, and steer 129° true (ESE mag.) in mid-channel between the two points; round **Observatory Point**, the low shingle point at the southeastern extremity of the eastern promontory, giving it a good clearance and anchor in 10 to 12 fathoms, mud bottom, in the middle of the harbor, halfway from Observatory Point to the church, with the church bearing 331° true (NW mag.), and the point bearing about 196° true (S mag.).

There is no wharf; a boat landing is made on the shingle beach in front of the village. Fresh water may be secured from a stream in the southern part of the bay. Soundings made in the harbor showed no dangers; but the head of the bay at the southeastern end is shallow, and can not be used. The harbor is surrounded by high land, with two valleys opening into the head of it. The position of Observatory Point is said to be latitude 53° 23′ 06″ N, longitude 167° 30′ 34″ W.

About 7 miles inland from the southwestern end of Unalaska Island there is a conical peak about 2,000 feet high, which forms an important landmark, as the other land in the vicinity is comparatively low.

SOUTH COAST OF UNALASKA ISLAND.

The southeastern coast of Unalaska Island from Udagak Strait to Umnak Pass, a distance of about 60 miles, is indented by many bays. There are no directions for this coast available. **Kuliliak Bay** (chart 9196) is about 30 miles east-northeastward of Umnak Pass; it is said to be about 500 yards wide at the entrance, and 1½ miles long in a northeasterly direction, with depths of 4 to 9 fathoms; there is no information about this bay except that contained in the published plan.

It is reported that the southern shore of Unalaska Island extends some miles farther south than charted.

UMNAK PASS

separates Unalaska Island from Umnak Island; vessels have used it, navigating slowly and cautiously, and using the lead constantly. It can not be recommended as a safe passage. The Coast Guard cutter *Manning* reports passing through in 1903, as follows: Give Samalga Island a good clearance; the southwest coast of Umnak Island has numerous outlying reefs, and care should be taken when approaching. Stand along the south side of Umnak Island for the Vsevidof Islands, and after rounding these islands, a course 61° true (NE mag.) for Tulik Volcano will bring the Pillars on the port bow.

Later the *Manning* passed through Umnak Pass during bad weather and saw no breaks except those charted. Rounding Polivnoi Rock at a distance of 1 mile, she hauled straight up for Ship Rock, carrying 18 to 30 fathoms of water. When within ½ mile of Ship Rock she hauled to pass ½ mile off, and stood through.

The Pillars are two rocks, 170 and 125 feet high, with a small detached rock about 100 yards northward. From the Pillars haul for **Kettle Cape**, and then proceed slowly and cautiously through the middle of Umnak Pass. Care should be taken to avoid the 3-fathom shoal about 2½ miles southeast of Kettle Cape. Avoid also the sunken rock which lies about halfway between the above shoal and Kettle Cape. The recommended track passes between these shoals, in a depth of 10 fathoms.

After passing Kettle Cape avoid the kelp patch ½ mile off the western side of the pass, between the cape and **Ship Rock**, which is about 300 feet high, and lies near Umnak Island on the western side of the northeast entrance of the pass. From Ship Rock a course may be laid for Chernofski Harbor.

The chart shows two islets and a rock southwestward of the western end of Unalaska Island, on the line of the point. The rock is reported as sunken, and at a distance of 4¼ miles from the point; it is on the southeastern side of the recommended track.

BOGOSLOF ISLAND

lies in Bering Sea about 22 miles northward of Umnak Island; it is reported as less than 1 mile in extent and 400 to 600 feet high. In 1914 there were three peaks; the southern one, called **Castle Peak** or Castle Island, was the highest, and was sharp in outline; the middle one, called **Perry** or **McCulloch Peak**, was also sharp; and the northern one, called **Fire Peak** or Fire Island, was flat or rounded in outline, and the lowest of the three. The three peaks are reported to be connected by low beaches of volcanic ashes and cinders. Records state that Castle Peak was first thrown up above the sea by a volcanic eruption in the year 1796; Fire Peak was thrown up in 1883, and Perry Peak in 1906; the three were found connected in a single island in 1907.

The locality should be navigated with caution, and future changes may be inferred. It is not known whether there are dangers in the vicinity; it has been reported that there is no bottom at 15 fathoms at distances of ½ to ¼ mile on the northern, western, and southern sides; but it has also been reported that there are scattered breakers on all sides except the west. Discolored water is often seen in the vicinity, which does not indicate shoals. It is reported that the

island was in violent eruption in 1910. The island forms a useful landfall on a course westward from Cape Cheerful, but it has been reported to lie 5 miles farther west than charted; the report would place it in longitude 167° 58′ W.

A **current** is often reported setting eastward in this vicinity, which is variously reported to set toward Cape Cheerful and toward Umnak Pass, with a strength of 0.1 to 0.4 knot. It is inferred that with a barometric depression near Unimak Pass it sets toward Cape Cheerful, but with a depression in the Pacific Ocean southward of Unalaska Island it sets toward Umnak Pass. Vessels coming from westward often make Cape Makushin ahead instead of to starboard.

UMNAK ISLAND

is, next to Unalaska, the largest island in the archipelago; it is about 70 miles by 16 miles in extreme length and breadth. The volcano of **Mount Vsevidof**, 7,236 feet high, is the summit of the island. It is a cone-shaped, snow-covered mountain sloping to the sea from north around to southwest. It is situated southwestward of the center of the island, near the western shore, with no other mountains southwestward from it.

It is reported that the entire north coast of Umnak Island should be approached with caution, and, in particular, that there is a rock, surrounded by 22 fathoms of water, off **Cape Tanak**, at the northernmost point. Vessels should pass a mile or more off **Cape Idak** and should keep outside the 100-fathom curve while rounding Cape Tanak.

Inanudak Bay lies on the northwest coast of the island; it has also been called **McAdoo Bay.** Anchorage is reported in the northern part of the bay, in 13 fathoms, inside the northern entrance point.

Nikolski Anchorage, or **Umnak Bay**, is about 14 miles southward of Mount Vsevidof. **Ananiuliak Island**, 5 miles northward of Nikolski and about 1¼ miles offshore, is about 200 feet high, kite shaped, and about 1¾ miles long in a north-northeasterly direction, tapering to the southwest. The area between this island and the main shore is reported to be foul. **Adugak Island**, about 12 miles west-southwestward of Nikolski and about 5 miles offshore, is about 100 feet high.

High Hill is 3 miles northward of Nikolski and shows flat topped from seaward; off the point southward of it there is a spit with kelp and 4 fathoms at the edge of the kelp.

A **reef**, shoal enough to break, is reported to exist about 5 miles 292° true (W ½ N mag.) from the village. The entire area southwestward of this reef, and between Umnak and Adugak Islands, is reported to be foul. Vessels should not attempt to enter this area, nor should they pass anywhere inside a line between the north ends of Adugak and Ananiuliak Islands, except close to the latter. There are dangerous tide races and currents off the entrance to Nikolski.

The best **anchorage** is in 12 fathoms on the port hand going in, off Kelp Point, about 4 miles 150° true (SE ⅛ E mag.) from the southwestern extremity of Ananiuliak Island. The anchorage, however, is not very good and with winds from west-southwest to northwest is not tenable. A nearer anchorage for boating purposes can be had in 14 fathoms off the southern point of the entrance to the small inner boat harbor.

Very small schooners and boats can enter the boat harbor through a passage with 4 fathoms of water, between the reefs off the village showing well above water and the right-hand point of land going in. There is a sunken rock with kelp on it in the channel. Going in, a course with the church open from a yellow-roofed house and midway between the house and the right point of the reef will lead clear of the rock. The boat landing is on a shingle beach in front of the village, where the surf seldom breaks except in very heavy weather.

The point about 4 miles west-southwestward of Nikolski village has many rocks off it above and below water, extending well out toward Adugak Island.

Samalga Island lies off the southeastern point of Umnak Island; the passage between it and **Cape Sagak** is reported dangerous. The island is low and sandy, and extends in a northeast and southwest direction. There is a fox farm on it. All navigators recommend giving it a good berth, on account of outlying reefs on all sides. There is a breaker reported westward of Cape Sagak and about on line between the western points of Samalga and Adugak Islands; another reef is charted off the southwest point of Samalga Island, on the axis of the island.

Driftwood Bay is on the southeast coast of Umnak Island opposite Nikolski village; vessels have anchored here, but no detailed information is available.

The southeast coast of Umnak Island should be navigated with great caution; reports state that it is foul and dangerous, but accurate information is not available.

ISLANDS OF FOUR MOUNTAINS

are a group of five volcanic islands lying southwestward of Umnak Island. Their names are **Chuginadak, Herbert, Carlisle, Kagamil,** and **Uliaga.** The group is about 20 by 30 miles in extent and is separated from Umnak Island by a passage about 17 miles wide.

The islands are all high and steep, and partly snow covered. The highest summit is **Mount Cleveland,** 8,150 feet high, on the western end of Chuginadak Island. The passages between the various islands all appear to be safe. There are no harbors, so that it is very difficult to find anchorages or landing places.

A reef which breaks heavily extends 1½ miles southeastward from **Concord Point,** the southeast point of Chuginadak Island. **Corwin Rock** is charted about 1½ miles northeastward of the northeastern point of the same island. There are strong tidal currents through the group; a current of 5 knots running about southwest is reported off Concord Point.

There is no other information about these islands except that given by the chart. This is the result of a reconnaissance in 1894, and the general features will no doubt be found reliable. These islands are uninhabited and are not often visited. There is an old report that a sounding of 13 fathoms has been made 50 miles southward of the Four Mountains; it is said that there was once an island there.

YUNASKA, AMUKTA, AND CHAGULAK ISLANDS

form a group westward of the Islands of Four Mountains; they are 2,800 to 4,300 feet high. Their positions are somewhat doubtful, and bearings among them do not agree. Reports have been received that Yunaska Island is charted 4 to 5 miles northward and westward of its true position. There is a high rock charted at the east point of Chagulak Island, a high rock between it and Amukta Island, and a high rock 1 mile southeastward of Amukta Island. There is no other information about these islands.

Amukta Pass is a broad clear passage, and is the first opening west of Unalga Pass which can be recommended to a stranger. It is often called the 172-degree pass. It is about 35 miles wide between Amukta and Seguam Islands; and no offshore dangers have been reported in it. The landfalls on both sides are good, but should be given a reasonably wide berth, as there are no soundings near their shores. Both Amukta and Seguam Islands may be seen across the full width of the pass in fair weather. Vessels have reported high breaking seas in Seguam Pass; it is probable that the current always runs northward through the pass, and in this case bad northerly weather would always cause this condition. Traders report that there is always a fair current from the Islands of Four Mountains to Cape Cheerful. In 1914 a 24-foot sea almost breaking was met eastward of Seguam Island, with northerly weather.

SEGUAM ISLAND,

2,098 feet high, shows two slight saddles in the profile from north and south. It slopes to the sea on the south and east sides, but has high cliffs on the northeast side. The middle peak is said to smoke at times. It is reported that rocks and discolored water extend for 1½ miles off the east and west points.

Seguam Pass lies between Seguam and Amlia Islands. It has been regarded with suspicion, and a sailing vessel has been lost on **Agligadak Reefs**, on the southwest side. The pass is about 12 miles wide, and it is reported that there are strong currents, rips, and overfalls. There are no reports of offshore dangers.

ANDREANOF ISLANDS.

Amlia Island is about 40 miles long and very narrow; there is a chain of sharp peaks throughout its length, no one of which is especially distinctive. Its shores should be given a good berth, particularly near the eastern end. The eastern point is a good landmark in fair weather. It is visible at a considerable distance, running out with a straight profile at a moderate elevation, and dropping to the sea in a precipice. It must be given a berth of several miles on account of rocks which are shown on the chart eastward and southward of it.

Sviechnikof Harbor (chart 9196) is on the south shore of Amlia Island about 15 miles from the eastern point. The entrance is difficult to make out, and should be attempted only in clear weather. **Sagigik Islet** about 9 miles eastward, and the pyramid peak to the right of the entrance, may be recognized. The harbor is said to extend about 2 miles in a north-northwest direction with a width of ½ mile, and is

sheltered from the sea by a narrow islet off the eastern entrance point. It is said to be an excellent harbor with good holding ground and protected from all winds. **To enter** hold the port side of the entrance until past the long island and the rocks and reefs which will be seen on the starboard side, then stand up the middle of the bay and anchor in 12 fathoms, mud bottom, with the waterfall open. Soundings have been taken in the bay which indicate that there are no dangers except the reef at the east entrance point.

Amlia Pass is a strait 1 to 1½ miles wide between Amlia and Atka Islands, and has been used by vessels. A current of 8 knots has been observed and there are strong tide rips across it which give it a very dangerous appearance. A sounding of 20 fathoms was obtained in these rips. There is an extensive ledge showing above water off the Atka Island shore. It is reported that only full-powered steam vessels should attempt to pass through, and that the Amlia Island shore should be held. One report says "favor the Amlia Island shore until up with the reef, and then steer about 169° true (SSE mag.) in mid-channel."

Atka Island is the largest of the Andreanof Islands; it is about 20 by 50 miles in extent and contains the last settlement westward in the Aleutian Islands, except Attu. The northeastern portion contains the active volcano of **Korovin,** 4,852 feet high, with slopes of the mountain breaking off in a rocky escarpment at the northern extremity of the island. The southwest portion of the island from Nazan and Korovin bays is lower and runs off to the narrow low southwest extremity.

Nazan Bay (chart 9196) lies on the eastern coast, facing Amlia Island; the west point of Amlia is a conspicuous landmark for making the bay. **Cape Kudugnak** is the northern point of the bay and consists of a rounded hillock. From here **Uyak Island,** 150 feet high, at the southern entrance to the harbor may be seen; or in case of fog the island may be picked up before the cape is lost. In foggy weather the harbor will often be found clear when there is fog at the cape. The northern part of the harbor is large and is unprotected from the east; it is about 1½ miles across, with depths of 15 to 20 fathoms.

The inner harbor lies in front of the village, and is small and protected, with depths of 7 to 10 fathoms. **Conical Rocks** form a single islet 80 feet high and lie northward of the inner harbor, between it and the northern harbor. There are two other islets between Conical Rocks and the shore, and foul ground around and between the three.

Bolshoi Island is a large island 400 feet high, forming the eastern side of the inner harbor, and lying near the shore in the southern side of Nazan Bay. There is a narrow passage 120 yards wide between it and the south shore. The northeastern and southeastern sides of the island are foul for some distance from its shores, and there are several islets adjacent to its eastern and southern shores. Foul ground is reported between it and Uyak Island.

The settlement consists of Indians and half-breeds; there is a small store, and a Government school conducted by a white teacher. There are no mail facilities; the only communication with the outside is by small trading schooners to Unalaska.

To enter Nazan Bay, round Cape Kudugnak, 1 mile distant, and steer 271° true (W by S mag.); Uyak Island is right ahead on this

course, and the course must be altered to pass it ¼ mile distant to port. Then steer 260° true (WSW mag.) about 1 mile, with the Conical Rocks right ahead. This course must be altered to pass Conical Rocks about 400 yards to starboard and about midway between them and Bolshoi Island. There are sunken rocks on both sides of the passage, generally marked by kelp. Then steer about 214° true (SSW mag.) for about ½ mile, to the anchorage off the village. Anchor in 10 fathoms, mud bottom, midway between the bluff on the village point and the rocky ledge at the point of Bolshoi Island; the anchorage is about 400 yards in extent. A vessel not desiring to come to the inner harbor may find anchorage anywhere northward of Conical Rocks. Fresh water can be obtained from a stream south of the village.

Korovin Bay (chart 9196), on the western side of Atka Island, opposite Nazan Bay, is reported to be about 7 miles by 4 miles in extent. It is open westward and has not been considered a good anchorage. There are two shallow harbors, or lagoons, in the northern part with 2 fathoms or less in them. At the head of the bay there are reported to be reefs well offshore. On the south shore are **Sand Bay**, called also Martin Harbor, and **Sarana Bay.** Both of these have been recommended, but there is no detailed information about them.

It is reported that the bearing between **Koniuji** and **Kasatochi Islands** is correct as shown by the chart.

Great Sitkin Island is shown on the chart as a volcanic peak 5,033 feet high, with its northern point marked by a rounded hillock 800 feet high. Off the eastern coast is **Ulak Island**, about 500 feet high. A vessel has anchored in the northeast bight of Great Sitkin, with offshore winds; 10 fathoms sand bottom was found 2 miles from the beach, with a gradual slope from the shore. A kelp patch extends 1 mile eastward, showing a depth of 3 to 7 fathoms.

There is no information about any of the other islands or passages between Atka and Adak Islands except the chart, which is said to be approximately correct.

ADAK ISLAND

is large and mountainous; some of the peaks are always snow covered. **The Bay of Islands** (chart 9196) lies on the northwestern shore, opening on Adak Strait. It has not been recommended as a harbor, as it is said to be open to westerly gales. Southward of the bay there is a landlocked basin about 2 miles long and 1 mile wide, which is entered from the head of the bay by a passage 25 yards wide. There is no other information to add to that shown on the chart.

The Bay of Waterfalls (chart 9196) is at the southwestern point of Adak Island, and opens on the Pacific Ocean. It is about 4 miles wide at the entrance, and extends about 8 miles inland in a northerly direction. The two entrance points are **Cape Yakak** and **Turret Point**, which form important landmarks for vessels passing southward of the islands. Cape Yakak is a long flat tableland, well defined and easily distinguished, as it has no high peaks on it and is the only point of that nature on the western Aleutian Islands; in clear weather

the high peaks of Kanaga Island loom up in the distance above it. Three miles eastward of Turret Point there is another bay called **False Bay**, which is distinguished from Bay of Waterfalls by two ragged islands on the eastern side which do not resemble Turret Point at all. Turret Point and Cape Yakak may be approached within less than 2 miles, but caution must be used, as there is foul ground closer in.

Chapel Roads is on the eastern side of the Bay of Waterfalls and offers convenient and sheltered anchorage in 20 fathoms, rock and sand bottom. **Chapel Cove** is at the head of Chapel Roads; the entrance is narrow, and almost in the middle of it has a pinnacle rock not marked, with 2½ fathoms over it. Inside the cove there is a ledge of rocks above water on the southwestern side, called **Pulpit Rocks.** There is swinging room for a 200-foot vessel with 45 fathoms of chain, if she anchors in the middle. There is 12 fathoms fairly soft bottom in this position.

Cataract Bight is on the eastern shore of the Bay of Waterfalls near the head; it is protected from the swell which runs in from the sea, but there is scant swinging room if a vessel swings toward the beach. In case of northerly weather a vessel should anchor at the head of the bay, selecting anchorage as desired, as there are no dangers. With southerly winds a perceptible swell reaches here from the sea. Fresh water may be obtained at any one of many streams in the bay. There is no settlement here.

No detailed directions are required for entering the bay. Except for the dangers already mentioned, the entire area is believed to be clear. From a position about midway between Turret Point and Cape Yakak a 4° true (N ¼ W mag.) course heading midway between Middle Point and Middle Rock leads through a least depth of 56 fathoms. From abreast Middle Rock follow a mid-channel course to the anchorage at the head of the bay.

Adak Strait separates Adak and Kanaga Islands; a vessel reports passing through it, keeping 1¼ miles off the points of Adak Island. There was a 2-knot current setting northward, and heavy tide rips and swirls were encountered at the north entrance. Soundings from 36 fathoms to no bottom at 90 fathoms were obtained.

Kanaga Island is reported to have a high smoking volcano on its northern end; the southwestern end has an elevation of 1,392 feet.

Tanaga Island is westward of Kanaga Island, and has a volcano 6,975 feet high on its northwest point. **Tanaga Bay,** called also Glory of Russia Bay, lies midway of the west coast. It is said to afford anchorage in the northern part near the head, abreast of two streams, over a bottom of fine black sand.

Tanaga Pass, westward of Tanaga Island, is reported clear by several vessels which have used it.

Gareloi Island is an active volcano which is reported to be a good landmark; it is 5,334 feet high and snow covered. There is a group of islands southward of it, for which no information is available except the chart. **Amatignak Island,** 1,921 feet high, is the southernmost of the group, and is an important landmark for vessels passing southward of the islands.

RAT ISLANDS.

Semisopochnoi Island, called also Island of the Seven Mountains, is shown on the chart as 3,112 feet high; it is important on account of **Petrel Bank,** which extends about 30 miles north-northeastward from it, and is about 18 miles across. The least known depth on this bank is 29 fathoms. It is very useful in navigating this region in foggy weather, when Semisopochnoi Island is obscured.

Amchitka Island is long and low. The northwest end is shown on the chart as 1,008 feet high. The eastern extremity forms a peninsula, from the end of which a reef extends for 2 miles; a hillock marks the extremity of this point. The offshore navigator can not expect to see Amchitka at all as there are no commanding elevations.

Constantine Harbor (chart 9196), near the easternmost point of Amchitka Island, on the northern side, is said to be the only harbor on the island. It is open northeastward, and is said to afford anchorage in depths of 8 to 12 fathoms. The chart shows the details, and there is no information except that shown.

Kirilof Bay is said to be only a small boat harbor inside the reef; vessels should not attempt to find a sheltered anchorage here.

Little Sitkin, Chugul (also called Iron Island), **Davidof,** and **Khwostof Islands** form a group of four; their positions have been disputed from time to time. The two largest are high volcanic cones with smooth slopes. Little Sitkin shows a long flat point at the northern side.

It is reported that there is a small island about midway between Little Sitkin and **Rat Island.** It is also reported that there is a reef all the way from Rat Island to the south end of Kiska Island, and that bottom can be seen all the way across; vessels have therefore regarded that passage with suspicion. There is no other information about Rat Island except the chart.

KISKA ISLAND.

The general trend of the island is north-northeast and south-southwest, with a ridge of mountains as a backbone, having elevations of 4,050 feet at the northern end, and 1,200 to 1,500 feet in the southern part. The shores are hilly and rocky.

The northeast coast, from Northeast Cape to Kiska Harbor, is bold with numerous points and bays, with outlying rocks to a maximum distance of about 1½ miles.

McArthur Reef, a rocky patch about ½ by ⅓ mile in extent, and nearly awash at low water, lies about midway of, and on a line between, the peak on Chugul Island and the peak on the north end of Kiska.

Tanadak Island is flat-topped, resembling a mesa when seen from a distance.

Tanadak Pass, between Little Kiska and Tanadak Islands, should be used with caution.

South Pass, between Kiska and Little Kiska Islands, is foul and should not be used.

Kiska Harbor is closed to foreign shipping.

is an important landmark. Its position has often been disputed, but is considered to be approximately correct as now charted. The island is said to be 1,145 feet high. Vessels have passed along the north shore, but the south shore has been regarded as dangerous. Vessels have found temporary anchorage near the western point in 10 to 15 fathoms about 1 mile offshore.

The north anchorage is about halfway between the two reefs shown on the chart, one off the north shore and the other off the northwest point. In approaching the anchorage avoid the reef on the north shore and stand in on a 163° true (SSE mag.) course nearly parallel to the reefs off the northwest point. This reef consists of a low, round knuckle directly off the point and two fairly high islands. Foul ground exists close around the islands. The north reef at low water shows two rocks close inshore, and more foul ground is supposed to exist. It is stated that almost the only possible boat landing on the island is at this anchorage.

The southwest anchorage is in 10 fathoms, with the sea-lion rookery bearing 41° true (NE by N mag.), distant 1 mile.

The passage between Kiska and Buldir Islands is about 50 miles wide; but can not be considered safe until it is more carefully explored. It is chiefly noted on account of a line of tide rips, breakers, and overfalls which are often seen extending well across between the two islands. The current amounts to a knot or more at times. The rips occur on banks of less than 100 fathoms surrounded by deeper water, and until the region is well explored, a vessel must proceed through them with caution, and should take soundings at all times.

There may be a dangerous shoal near the 15-fathom sounding charted 10 miles from Buldir on a line toward the middle of Kiska; breakers have been reported here. There are indications that there may be a dangerous shoal halfway between Buldir and the south end of Kiska; and there have been reports to that effect. There is no information to verify the two reefs marked "P. D. sunken rocks" 10 miles southward and 6 miles southeastward of Buldir, and they may be anywhere in a wide region round about. One report places them about 14 miles southwestward of the island.

Tahoma Reef is a reef of sunken rocks about 2 miles in extent, marked by heavy kelp fields, lying 189° true (S ⅛ W mag.), distant 31 miles from the peak of Buldir Island. Breakers were seen in about 2 fathoms, but there are no rocks above water. There are other breakers about 2 miles 108° true (E by S mag.) from the position located. Depths of 60 fathoms were found 6 miles distant southward and westward, with a regular slope from the reef to this distance.

Ingenstrem Rocks consist of a number of small black pinnacles about 20 feet high, with breakers near them. The water shoals to 50 fathoms within 3 miles of them, and there is moderately shallow water between them and the Semichi Islands. The latest information places their position 13 miles 121° true (SE by E ¾ E mag.) from the southeastern end of the Semichi group.

The **Semichi Islands** are a group of three, of which the two eastern ones are low and the western one higher. There are reefs extending about 1½ miles southeastward and northeastward from the eastern

point of the group. The passages between the islands are narrow and appear to be foul. A safe track was found 2 miles off the southern coast. Temporary anchorage may be found southward of the eastern island.

AGATTU ISLAND

has high mountains upon it, while the extreme western point is low. There are reports that the shape does not agree with the chart. It is reported that the northeast and southeast points are in range on a bearing 23° true (N by E ⅜ E mag.), and that the eastern point of the Semichi Islands lies on the same range. A course from the Semichi Islands to the western point of Agattu indicates that this point is charted about 4 miles too far westward. The southern coast of Agattu is dangerous, with numerous outlying rocks and breakers. A vessel should keep at least 3 miles offshore.

McDonald Bay is an open anchorage on the east coast. Approaching it from northward bring Northeast Cape to bear 241° true (SW by W mag.) distant 3 miles, and then steer 213° true (SSW ½ W mag.) until it bears abeam. Then steer for Monolith Point at the north point of the cove on a course 255° true (WSW ¼ W mag.), and when Cone Peak bears 325° true (NW ½ N mag.) with a waterfall about in range, round to and anchor in 15 fathoms, sand bottom, about ½ mile offshore.

ATTU ISLAND

is the westernmost of the Aleutian Islands, and the last of the islands belonging to the United States. It is about 20 by 35 miles in extent and is indented by many bays and long inlets; there are mountains 3,000 feet high upon it. There are many rocks and reefs off its shores, and a vessel should exercise extreme caution in the vicinity. It is reported that there is a rock about 15 feet high, connected with the land by a line of breakers, located 3 miles 125° true (SE by E ½ E mag.) from East Cape, and that the cape should be given a berth of at least 4 miles.

The chart shows several deep bays on the south coast and many offshore dangers, but there is no other information about them. Sarana Bay on the northeast coast and Chichagof Harbor on the north coast are the only bays for which there is available information.

Chichagof Harbor (chart 9196) is small, but offers good shelter for a vessel of less than 14 feet draft. The chart is said to be correct in all essentials for navigation, but there may be considerable difficulty in finding the bay in bad weather. A vessel should therefore proceed with caution, especially in bad northerly weather. Strong currents set northeastward and southwestward past East Cape, which are possibly influenced more by the weather than by the tide.

There are rocks for a distance of about 1 mile eastward of **Cape Khlebnikof**, which is the landfall in the approach from East Cape or from northeastward. **Cooper Island** is high and dome-shaped, and **Gibson Island** is lower and flat-topped. **Pisa Tower** is a leaning conical rock at the east entrance point, which is used as a front range mark. An outer anchorage is reported in 14 fathoms with Cooper Island dome bearing 309° true (NW by W mag.) and Pisa Tower bearing 185° true (S mag.).

To enter the inner harbor, steer for Pisa Tower on a bearing which will lead clear of Gibson Island, and when passing between Pisa Tower and Middle Rocks avoid opening the flagstaff in the village clear of Range Point, bearing about 233° true (SW ¼ W mag.). This range leads over the 2½-fathom spot marked by kelp, which lies off Middle Rocks. Then stand through the middle of the passage between Range Point and Inner Rocks, and round to about 275° true (W mag.), heading for the southernmost of five jagged heads on the shore just above the water line; keep both leads going, and when the dome of Cooper Island shows in the open, round slowly to a course about 224° true (SW ½ S mag.), heading about halfway between the gulch and the village. Anchor in the middle of the harbor, in 5 fathoms, sticky bottom. The flagstaff will not be seen until well in toward Range Point. A vessel must be maneuvered smartly, as the turns are sharp and there is little room.

There is an Aleut settlement here, with a small store kept by a white trader; some blue foxes are bred on the neighboring islands.

Sarana Bay is a deep indentation on the northeast shore of Attu Island between Cape Khlebnikof and East Cape. The Coast Guard cutter *Tahoma* anchored in the cove at the head of the bay, and the available information is furnished on a sketch by that vessel. The sketch shows foul ground extending about 1 mile eastward from Cape Khlebnikof and off the western shore of the bay. The south shore apparently is bold from the head of the bay to "Square Point," but is foul eastward of the point; there is a cascade eastward of Square Point.

The *Tahoma* entered on a 196° true (S by W mag.) course for Square Point open eastward of a notch in the mountain, until close to Square Point, and then followed the south shore on a 269° true (W ½ S mag.) course, midway between an islet and the south shore, and anchored in 9 fathoms, soft bottom, close to the head of the bay. The anchorage is exposed from about north to east (magnetic).

BERING SEA.

The portions of Bering Sea here treated include the coast and islands of Alaska northward of the Aleutian Islands. Excepting a few localities, this territory has not been surveyed, and the charts of it are only compilations from various sources, with corrections made from later information received; the charts are necessarily imperfect and must not be followed implicitly, especially when in the vicinity of the coast. Then, too, the currents are much influenced by the winds, and are imperfectly known and difficult to predict, so that positions by dead reckoning are uncertain and safety depends upon constant vigilance.

Northward and eastward of the 100-fathom line the waters of Bering Sea shoal gradually to the coast. There are no dangers in the open sea, unless the Pribilof Islands, St. Lawrence Island, St. Matthew Island, King Island, and Diomede Islands be considered as such. These, being volcanic in character and rocky, are generally bold-to, and in approaching them in thick weather the lead can not be depended upon at all times to keep clear of them. The coast of the mainland from the head of Bristol Bay to St. Michael, including Nunivak Island, is characterized by extensive banks, formed by

deposits from the rivers, which extend many miles from shore, in some cases out of sight of land. Some of these shoals are believed to be quite steep-to on their seaward faces, making it unsafe to shoal the water to less than 10 fathoms when in their vicinity.

In this region, where fog and thick weather are the rule during the season of navigation, safety, when near the coast, depends on the use of the lead, which, on account of the generally regular bottom, will indicate the approach to danger. In general, all the shores of Bering Sea and the Arctic Ocean are shallow, and when coasting it should be observed as a rule to keep the lead going constantly, and when north of St. Michael never to shoal the water to less than 5 fathoms unless feeling the way in to the land. Between St. Michael and the head of Bristol Bay the water should not be shoaled to less than 10 fathoms under the same conditions.

There are few aids to navigation. All of the rocky islands and rocky cliffs of the mainland are frequented by thousands of birds, whose numbers, constant cries, and flight may serve to indicate the approach to shore at these places in thick weather.

The coast of Alaska from the head of Bristol Bay to Point Barrow and eastward has driftwood, which is brought down from the interior by the rivers and carried by the northerly currents of the sea. Good water can always be found in the vicinity of high land. Salmon are plentiful during the open season in all the streams as far north as Kotzebue Sound, and cod are plentiful in the vicinity of the passes and in Bristol Bay.

Ice.—Except in bays and sheltered places, the ice of Bering Sea is detached fields, floes, and cakes, which are continually kept in motion, breaking up, piling, and telescoping by the action of variable winds and currents. At no time is the sea one solid sheet of ice, and in the winter, while it is forming, it is more scattered than in the spring, when the northerly movement has begun and it packs closer together. The general southern limit of ice is from Bristol Bay to the vicinity of St. George Island, and thence about west-northwest to the Siberian shore. The southern edge is ragged and very much scattered, and continued northerly winds sometimes drive fields of it far southward. As a rule, no heavy ice will be encountered south of the Pribilof Islands, and the ice in their vicinity is likely to be nothing more than detached fields.

The ice conditions in Bristol Bay have so far received little notice. Reports have been received that the bay is usually free from heavy ice between the middle of May and June 10. In 1899 the steamer *Jeanie*, of 1,000 tons and a draft of 18 feet, reached Clark Point, in Nushagak River, on April 4, and was discharged on April 15. At this time the ice in the river above Fort Alexander remained solid, but two weeks afterwards it broke up and came down the river in large pieces, which would have endangered any vessel at anchor. In approaching the Nushagak River some ice was encountered about 75 miles from Cape Constantine, but not sufficient to seriously interfere with navigation. On May 10, 1896, a vessel bound for Bristol Bay was brought up by the ice, which extended from Port Moller to St. George Island, and she was not able to reach the Nushagak River until 30 days later. It is within reason to believe that some years Bristol Bay is open to navigation all winter, though the rivers and sheltered bays are closed.

The information regarding ice conditions in Kuskokwim Bay and River is very meager. In general, however, this region may be expected to be clear of ice about June 1. See also page 250.

In the spring, beginning with April, there is a general northward movement of the ice, the shores clearing ahead of the center of the sea; but it sometimes hangs in the bays and around the islands later than in the open sea. Seasons vary, the movement and position of the ice depending greatly on the direction of the winds. Generally, however, by June 1 the whole body of ice is well up with St. Lawrence Island, and a passage opens to its west side. The eastern side of the sea is likely to be obstructed a little later than the western side, and ice is often met between St. Lawrence Island and Nunivak Island in the early part of June. The breaking out of the rivers toward the latter part of May clears the shores, but the ice is likely to hold in Norton Sound several weeks later.

In general, for a vessel not fitted to encounter ice, Norton Sound is not navigable before the middle of June, often not before June 20 to 25, and has been known to be as late as July 10. On entering the sound about this time, strips of ice are often encountered after the sound can be said to be navigable. From the deck these may appear extensive and solid, but from aloft clear water may be seen beyond and through them. At the opening of navigation the ice is likely to be heaviest and to remain longest on the north shore, and, in general, it is the last of June before that part of the sound is altogether clear.

In the fall young ice begins to form on the rivers, and in the bays and sheltered places after October 1, and grows stronger and spreads according to the severity of the advancing season. Navigation is considered unsafe in Norton Sound after October 15.

Currents.—There has been no systematic study of the currents of Bering Sea, and the almost constant fogs prevent the navigator from adding much to our meager knowledge concerning them. It is said that in general the currents are greatly influenced by the tide and winds. The following observations apply to the open season, when the flow of the currents is not obstructed by ice:

Between Cape Cheerful and St. George Island the current is not believed to have any decided set or flow unless influenced by the wind. With a strong wind a current is likely to set with it, but ½ point allowance in a course will be sufficient to overcome any set that will be found in this vicinity due to this cause.

Between St. Matthew and Nunivak Islands the set of the current is northward; with prevailing northeast winds it sets northwest, and with northwest and southwest winds, northeast. This northerly current continues and increases between St. Lawrence Island and the mainland, being stronger toward the mainland north of the mouth of the Yukon River, where it amounts to about 1 knot, except in the early summer, when, increased by the freshets in the Yukon, it may amount to 2 knots or more. A strong northeasterly current setting on the Yukon flats has been observed, amounting at times to 2½ knots. The current sets north across Norton Sound to Sledge Island and then follows the coast to Bering Strait. It is strongly marked between Sledge Island and Bering Strait.

In Bering Strait the current sets north, and when not influenced by wind its velocity is about 2 knots an hour. Protracted northerly gales which prevail in the autumn change its direction to southward,

but on the cessation of the wind it quickly sets north again. Strong southerly gales increase its velocity to 3 knots. The current is stronger east of the Diomede Islands than west of them.

A current sets strongly from Cape Newenham through Etolin Strait.

Tidal currents.—In the southern part of Bering Sea, inside the 100-fathom line, and through the various passes in the Aleutian Islands, the tidal current sets northward or northeastward during the rising tide, and southward or southwestward during the falling tide. In some of the passes it sometimes has a velocity of 9 knots; when clear of the passes its maximum velocity is about 2½ knots. At the Pribilof Islands, Nunivak, St. Matthew, and St. Lawrence islands the tidal currents have considerable velocity. The flood current sets eastward and northward and the ebb westward and southward. In Bristol Bay the tidal currents have considerable velocity. They have also considerable velocity at the Kuskokwim River and north to the mouth of the Yukon, especially in Etolin Strait and about Cape Vancouver.

Fog is most prevalent during spring, summer, and early fall, and it generally begins to clear about the middle of October. In summer fog is almost continuous, but few days are clear from morning to night, and the tops of the mountains can seldom be seen. At the surface of the water it is generally sufficiently clear to make out the shore at a distance of 3 or 4 miles, but at times it is so thick that nothing can be made out, and under such conditions strangers should not attempt to make the land. During the summer months the mist and fog are considered to be worse on the south side of the Aleutian Islands than on the north side in their immediate vicinity.

Weather.—The most striking feature about the weather in Bering Sea is its great uncertainty throughout the year. Good weather is rare and not lasting, and the winds can not be depended upon to remain long in one quarter. The late spring and summer are mild and very foggy, with frequent periods of light weather, comparatively few strong winds, and considerable rain. After September 1 gales become frequent and heavy, fogs gradually lessen, and toward the latter part of the month snow often accompanies the storms. During all the fall, gales are frequent, violent, and from almost any quarter.

During the fall and winter there are often periods of very low barometer (readings below 29.00 being common) accompanied by moderate to strong gales, with rain or snow. These gales, though sometimes very severe, are usually not so strong as would be expected by the fall of the barometer. After December and continuing into the spring there are often periods of moderate weather, and while severe gales occur, they are less frequent than in the fall. Strong winds or gales from any quarter always bring thick weather, rain, or snow. With easterly or southerly winds the rain is continuous, while with westerly or northerly winds the rain or snow occurs at intervals in squalls, and when the wind subsides the weather is likely to be clear.

Southeast gales, with falling barometer and rising temperature, are almost invariably preceded by an unusual clearness of the air; cirrus clouds are seen southwestward, which gradually thicken and overspread the sky. The wind usually shifts to southwestward when the barometer ceases to fall, but it sometimes backs from southeast to northeast, and generally goes to northwest before subsiding. Upon abating, the gale is followed by light westerly winds and comparatively clear weather.

BRISTOL BAY.

Bristol Bay may be said to include all that part of Bering Sea lying east of a line drawn from Cape Sarichef, Unimak Island, to the Kuskokwim River. Unimak Island and the Alaska Peninsula bound it on the south and east, and separate it from the Pacific Ocean. The Naknek River is at the head of deep-water navigation, while the bay itself terminates in the Kvichak River, a few miles northward. The region about Nushagak River, Kulukak Bay, and the Kuskokwim forms its northwest boundary.

The shores are usually low and without distinctive features, but high mountain ranges and volcanic cones extend along the central parts of Unimak Island and the Alaska Peninsula. These rugged snow-covered mountains and lofty peaks would serve as unmistakable landmarks were they not obscured by the almost constant fogs which prevail in that region during the summer months. The shore and objects near the sea level are often seen beneath the fog when the higher lands are obscured, and, therefore, most of the available landmarks are found on or near the beach.

The winds and weather in Bristol Bay and the other parts of Bering Sea visited by the *Albatross* from the last of May to the 1st of September, 1890, may be summarized in a few words.

Southwest winds prevailed, but we had them frequently from southeast to northwest. It was boisterous weather nearly half the time, but seldom rough enough to interfere with our work. We had several summer gales of moderate force, but no severe storms. Fog and mist prevailed, and a clear day was the rare exception. The tidal currents were strongest in the vicinity of Unimak Pass and at the head of the bay; they were greatly affected, however, by the winds. The flood stream sets northward and slightly inshore along the coasts of Unimak Island and the peninsula, the ebb southward and offshore. The former was invariably the stronger, and probably found an outlet by sweeping past Cape Constantine in the direction of Cape Newenham.

Reports have been received which indicate an easterly set, variable in velocity, along the northern side of Alaska Peninsula and in Bristol Bay.

COAST FROM UNIMAK PASS TO PORT MOLLER.

Cape Sarichef, Unimak Island, is described on page 195; it is low with detached rocks close inshore, around which strong tidal currents sweep. The land falls away eastward in a gentle curve, forming an open bay, called **Dublin Bay**, about 4 miles in depth between the cape and Cave Point, which lies 16 miles from the former. This bay may be used as a temporary anchorage by vessels of any size. The holding ground is said to be good. **Cave Point** is a vertical, rocky cliff, about 150 feet in height, and takes its name from a cave on its face, inhabited by sea birds, which in summer hover about it in thousands, making it conspicuous in clear weather by their numbers, and in fog by their constant cries. The snow-clad peak of **Pogromni Volcano**, rising to an altitude of 6,500 feet above the sea, forms a striking background to the low, monotonous coast.

Passing **Cape Mordvinof**, a low, bluff point about 13 miles from Cave Point, the coast falls away slightly for 6 miles, when it turns abruptly eastward for 5 miles, and then takes a northerly direction, forming **Urilia Bay**. This bay is open northward, but affords protection from all winds from southward of east or west. The approaches are clear, and the water shoals gradually to 6 fathoms, black sand, about ¾ mile from shore.

From **Urilia Bay** to **Isanotski Strait** the coast trends in a northeasterly direction, is very low, and has several rocky patches extending ½ to 1 mile from shore, making navigation unsafe inside the 12-fathom line. The volcano of **Shishaldin** rises 9,387 feet about midway between the above points and 7 or 8 miles inland. Isanotski Strait is available only for vessels of the smallest class.

From the strait to **Cape Glazenap**, about 19 miles, the coast retains the same general direction and is very low until reaching the latter point, which is oval in form, about 150 feet in height, and has been called Round Point.

Izembek Bay covers a large area at high tide, but much of it is dry at low water. A small vessel may, however, find a secure harbor behind the cape. The channel follows close around the point, and has a depth of 10 to 12 feet on the bar.

Amak Island is of volcanic origin, about 2½ miles in length, 1½ miles in width, and 1,682 feet in height. It lies 12 miles northwest from Cape Glazenap. The beaches are mostly huge bowlders and bluffs 30 to 150 feet high. The central peak is a dark-brown rock, bare, rugged, and precipitous. The southeast point is in latitude 55° 25′ N and longitude 163° 08′ W. There is foul ground off the northwest end of the island, several rocks awash or under water, and **Sealion Rock** between 2 and 3 miles distant. The latter is several hundred yards in extent and about 150 feet high, its slopes being occupied by an extensive rookery of sea lions.

A reef about ¼ mile long lies off the southeast end of Amak Island; about 250 yards of this reef shows bare. A reef, which breaks in a moderate swell, has been reported 3 miles about 63° true (NE mag.) from the summit of the island.

It is reported that a fair lee and anchorage with hard bottom can be found on the southeast side of Amak Island, and one not so good on the southwest side, but the foul south point of the island must be given a wide berth.

The **Kudiakof Islands** extend about 19 miles between **Cape Glazenap** and **Moffet Point**. They are but little above high water, and some of them are connected by narrow spits at low water.

From Moffet Point the low coast extends 15 miles to **Gerstle Bay**, then northward and eastward about 55 miles to **Wolf Point**, on the western side of the entrance to Port Moller.

The **Kudobin Islands** occupy the last 23 miles of this distance. They are very low, and it is difficult to distinguish them from the mainland, the only distinctive feature being a knob about 25 feet high on the east end of **Kritskoi**. The land between Herendeen Bay and **Nelson Lagoon** is very low. A cannery is operated in Nelson Lagoon, inside the Kudobin Islands, but no directions for reaching it are available.

PORT MOLLER.

The surveys of Port Moller (chart 8833) are incomplete. A party of the Coast and Geodetic Survey made a partial examination in 1910, the work being confined to the vicinity of Entrance Point. The following information is from the report and examination by that party supplemented by later information furnished by the Pacific American Fisheries, which company operates a cannery in the port.

Port Moller is surrounded by high mountains, and there is a high ridge across its head. The shore is steep and rocky except at the spits. **Kudobin Islands** are low and afford no definite features on which a bearing can be taken. **Doe Point** and **Point Divide** are bluffs and can be seen from some distance outside of Entrance Point. **Harbor Point** is a low, narrow, grassy sand and shingle spit, which can not be made out distinctly until nearly up with Entrance Point.

Port Moller and Herendeen Bay are indicated from seaward by a valley receding into the mountains. The land at the entrance is low and the chart indicates extensive shoals in the approach, so that access would be somewhat difficult in bad weather even if the charts were based on an accurate survey. The only channel of which we have any knowledge lies on the eastern side of the entrance, and **Entrance Point**, a low grassy spit, is the leading mark for entering. It is marked near the end by sand knolls, some noticeably eroded on the offshore side. There is deep water close to its southwest end, but a shoal extends some distance offshore from its outer side.

In 1910, a depth of 14 feet, with deeper water southwestward, was found 3 miles 329° true (NW ½ W mag.) from Entrance Point. A report received in 1914 indicates that this shoal is making westward, that its present western limit is about longitude 160° 38′ W, and that a line drawn 300° true (W by N mag.) from the end of Entrance Point is parallel to the southern edge of the shoal, and passes about ¼ mile southward of it.

A shoal with little water over it and on which the sea generally breaks at low water lies about ¾ mile westward (true) from the end of Harbor Point and extends nearly 2 miles in a 354° true (NNW ¼ W mag.) direction. It then turns northward toward Entrance Point for nearly 2 miles. The knuckle at the eastern end of the shoal lies 1¼ miles 185° true (S by E ¼ E mag.) from Entrance Point and is a little westward of a line joining Entrance and Harbor Points. The 1914 report places the northern limit of this shoal in latitude 55° 59.6′, and its eastern edge as continuing in a direction about 334° true (NW mag.) from the limits as described in the first part of this paragraph, and passing about ½ mile to the westward of Entrance Point.

A **channel**, having a fairly uniform width of about ½ mile leads between the two shoals here described, and between the south shoal and Entrance Point, thence continuing southward as shown on the chart. On either side of this channel, particularly in the narrower parts, the shoaling is said to be so abrupt that the lead can not be relied upon to give notice of danger in sufficient time to prevent grounding. The bight on the southeast side of Entrance Point is shoal except for the narrow channel which leads up to the wharf.

A reconnoissance line of soundings shows that the deep channel continues past Harbor Point, lying fairly close to it, and for some

distance farther southeastward exists about as shown on the chart. The two shoals southeastward of Harbor Point are about as indicated on the chart, and the bight on the southeast side of Harbor Point is shoal.

Good **anchorage** is found about ¾ mile from the outer side of the spit of Harbor Point, the southern end of the point bearing 177° true (SSE mag.), distant about 1¼ miles, in 10 to 15 fathoms. It is well sheltered from the sea in southeast gales, but the wind draws down the bay with great force. The shoals apparently would afford some protection with on-shore winds. Vessels may anchor above Harbor Point, but the shelter is less in southeast gales and is apparently no better with winds from other directions unless from west or northwest. The tidal currents at the anchorage have some strength, and heavy tide rips occur off Harbor Point.

The Pacific American Fisheries maintain a cannery in Port Moller, its location being about ¼ mile inside Entrance Point; 24 feet of water is reported at the dock. Fresh water is piped to the dock.

The following **directions** for entering were furnished in 1914 by Capt. Jackson of the steamer Windber, and verified in 1915 by Capt. Knight of the steamer Pavlof. It must be borne in mind, however, that future changes in the extent and location of the shoals may necessitate radical changes in these directions. In fact, strangers are advised to anchor outside and obtain information from the cannery before entering:

From off Walrus Island steer about 120° true (E by S mag.) for the end of Entrance Point. When on the bearing a white beacon on Entrance Point should be on range with another beacon on the high bluff across the bay. Hold this course until ¾ mile off Entrance Point, then haul and round the point not more than ¼ mile off. The range beacons and a number of keg buoys are maintained by the cannery and will lead in deep-water channel after the opening of navigation each season.

To make the anchorage northward of Harbor Point, pass ¼ mile southwestward of Entrance Point on a southeasterly course, and then bring the point astern on a 174° true (SSE ¼ E mag.) course until 1¼ to 1½ miles from it. Then steer 188° true (S by E mag.), heading to pass about ¼ mile westward of the end of Harbor Point.

HERENDEEN BAY.

There is no information regarding this region other than that which may be taken from chart 8833. In using the chart it should be borne in mind that, except for the area already described, the surveys upon which it is based were made in 1890, and that all information available points to extensive changes since that time, particularly in those areas exposed to the action of the sea.

Mine Harbor is small but free from dangers, except **Midway Reef,** which extends ⅜ mile from its eastern shore and shows at half tide. Anchor northwestward of Midway Reef in 12 to 15 fathoms, and if intending to remain any time it is advisable to moor. A reef extends 600 yards westward from **Crow Point,** the south point of Mine Harbor. **Crow Reef,** bare at low water, lies ⅞ mile westward of Crow Point and ½ mile southward of Bluff Point.

Tides.—It is high water in Mine Harbor, full and change, at 8h. 0m., rise 15 feet, and it occurs at Entrance Point about 2 hours earlier, with a rise of 10 to 12 feet.

Hague Channel is 1 mile wide at its northern entrance, and is contracted to less than ½ mile between Point Divide and Doe Point. The tidal currents are very strong, and near high water they sweep across the narrow channel and over the flats, making it impossible to steer a compass course. They are more regular near low tide, which is the best time to make the passage, as the channel is indicated by the flats showing above water on either hand.

Johnston Channel, Herendeen Bay, has 7 to 15 fathoms, but is very narrow with steep sides. It is difficult to find, but once in, the navigation is comparatively simple, as the tidal currents follow the general direction of deep water. The width of the channel at the northern entrance, ⅞ mile south of Point Divide, is ¼ mile, with little variation until near the southern extremity, where it contracts to 250 yards. Having cleared the channel and entered the upper bay, there is ample room and depth of water in every direction, Crow Reef, off the south point of Mine Harbor, being the only outlying danger.

Anchorages may be found anywhere between Walrus Island and Entrance Point in case of fog, and a vessel may anchor in Hague Channel, but the tidal currents are strong. There are fairly good anchorages under the north side of Point Divide and Doe Point, where, near the bank, a vessel will be out of the strength of the current. The *Albatross* anchored in mid-channel, 1 mile inside of the above points, at the time of spring tides, and the flood came in with a bore between 2 and 3 feet in height, the patent log registering a 9-knot current for some time, with a swell which occasionally splashed into the scuppers. There is a fair anchorage off the northern entrance to Johnston Channel, and an excellent one at its southern extremity, off Marble Point, just north of Shingle Point, or, in fact, almost anywhere in the upper bay. The last quarter of the flood tide is the best time to pass through this channel.

High land rises at the base of Harbor Point and extends northward and eastward near the middle of the peninsula. **Point Divide** is 50 feet in height, and mountain ranges rise a few miles back. The coal measures are found between Mine Harbor and the head of Port Moller. **Doe Point** is 40 feet in height, while the rest of Deer Island and the mainland south and west of it are generally lower. The southern shores of Herendeen Bay are mountainous, with intervening valleys, the whole face of the country being covered with rank grass and wild flowers during the summer months; but there is no timber, except occasional small poplars, alder bushes, and willows. Fresh winds, with fog and mist, blow across the low divides from the Pacific, obscuring the sun and greatly increasing the rainfall in Port Moller and vicinity.

There are no large fresh-water streams entering the bay, which probably accounts for the absence of Eskimos.

PORT MOLLER TO KVICHAK RIVER.

The coast is low for 19 miles between Entrance Point and **Cape Kutuzof**, which rises in a rounded bluff to an elevation of 150 feet.

Cape Seniavin, 11 miles northward and eastward, is a rocky point 75 feet high. Passing it the low, monotonous beach continues to the Seal Islands, the only exception being a cluster of small hillocks near the beach, 12 miles from Cape Seniavin.

Seal Islands are several small islets, but little above high water, strung along near the coast for about 10 miles; thence to **Strogonof Point** the land continues very low.

Port Heiden is said to be a good harbor, but it has not been examined. The approach to the port will be recognized by high, bold headlands, which rise from its northern shore. Another report states that intricate and irregular sand banks not shown on the chart are found for a distance of 5 miles offshore. Depths of 3 fathoms are reported on these shoals.

Chistiakof Island, low and crescent shaped, forms the seaward side of the harbor, the channel lying between its northern extremity and a reef which makes westward about 3 miles from the land about 2 miles northward from the island. An extensive reef is also reported to extend about 1½ miles off the northwest side of Chistiakof Island. It is reported that there is a rise and fall of 18 feet on the largest spring tides, and about 12 to 14 feet on ordinary tides.

Until a proper survey of the Bristol Bay region has been made it must be regarded by mariners as a dangerous locality to navigate; it is only by the greatest vigilance and constant use of the lead that disaster can be avoided upon approaching the land. This is particularly true of the northeast arms and approaches which receive the waters of the great salmon streams on which all the Bering Sea canneries are located.

These rivers are the Igushik, Wood, and Nushagak, emptying into Nushagak Bay; the Kvichak, Alagnak, Naknek, and Ugaguk, which empty into Kvichak Bay; and the Ugashik, next southward of the Ugaguk. These rivers are large and discharge a great quantity of water into wide indentations, locally still retaining the name of rivers, which open on the arms of the great bay. The banks of the rivers are frequently marshy, generally muddy, and the discolored water is charged with a large amount of sediment, which is deposited, forming the dangers to be encountered.

On account of the funnel-shaped configuration of the bays and river entrances, the tidal currents run with great force, having a velocity at times of at least 6 knots, and the tides have a rise and fall of 18 to 24 feet; vast areas of shoals are uncovered at low water, leaving only pools and shallows, and generally narrow channels between. Navigation in the arms and approaches is only successfully accomplished at or near high water, even by those thoroughly acquainted with the channels.

From Port Heiden the same low coast extends to Cape Menshikof in nearly a direct line, the high land of Port Heiden gradually receding from the coast. A shoal inlet or river entrance lies about 10 miles southward of Cape Menshikof. It has sometimes been mistaken for the Ugashik River. **Cape Menshikof** is a high bluff, extending some distance along shore, with hilly country back of it.

False Ugashik is about 10 miles below the Ugashik River, and because of the similarity of the shore line of the two, False Ugashik has often been mistaken for the Ugashik. The charts show a broken coast line where this inlet should be.

Ugashik River is large and empties into the wide indentation between Capes Menshikof and Greig, the distance between the capes being about 15 miles. The capes can be approached from westward as close as about 2 miles. The coast between the capes including

the river valley appears low. **Smoky Point**, a bluff on the north side at the entrance, is about 7 miles southward of Cape Greig. Here the river is about 4 miles wide at high water. The indentation between the capes and the mouth of the river are filled with shoals. There is a channel with about 10 feet at low water, which is buoyed during the season for the use of the cannery vessels, but a stranger could not follow it with safety.

There is communication by telephone among some of the canneries at the head of Bristol Bay from Ugashik River to Nushagak River.

Cape Greig is a prominent brownish bluff, with a few yellow vertical stripes, 243 feet high, extending several miles along shore. It appears to be the seaward end of a low ridge with low land on each side. This and a peculiar notched mountain some distance inland are good marks. The low coast continues from the cape to the Ugaguk River and thence to the Naknek River with hardly a distinguishing feature except **Johnston Hill** a solitary elevation 5 miles from the beach and about 9 miles southward from the mouth of the Naknek.

Ugaguk River empties into the outer limit of Kvichak Bay about 30 miles north of Cape Greig, and has **Cape Chichagof** for its northern entrance point. It is a large river, about 2 miles wide at the cannery, and is the outlet of **Lake Becharof.** It flows in a general westerly direction for about 50 miles. Tidewater is said to extend about 25 miles up the river; very little is known of the locality.

The lower part of the river is a wide bay, contracted at the mouth, and, like other rivers of this district, at low water a large part of the bed is exposed in shoals and banks with narrow channels winding through them. At the entrance shoal water extends several miles offshore, and the small cannery steamers enter only from half to full tide. The channel into this river is wider and deeper than in Naknek and Kvichak, and, if it were properly buoyed, vessels of moderate draft could enter at high water, but there is no swinging room inside. The cannery transporting vessel, a bark of 554 tons, was carried in at high water and moored head and stern alongside the low-water bank. A cannery is located at Ugaguk, and another on the north shore northwestward from Ugaguk.

Naknek River may be considered as the head of deep-water navigation in Bristol Bay. It enters Kvichak Bay on the eastern side, about 25 miles southward of **Kogiung.** The river has its source in the large lake of the same name as the river, on which two villages are located. The river is large and about 60 miles in length.

It is said that tide water extends about 25 miles from the mouth, where the river is about ½ mile in width, and that at the mouth the extreme rise and fall of spring tides is over 20 feet.

Shoals and banks, many of which uncover at low water, fill the lower course of the river and extend 3 or 4 miles off the mouth, then trend around northward and join the body of the banks that fill the upper end of Kvichak Bay. At low water the channel between the banks and flats is very shallow; cannery steamers, drawing but 7 feet of water, await half tide before entering. Navigation is done on the rising tide or at high water. High water, full and change, 1h. 5m.; rise 23 feet.

The mouth of the river is about 3 miles wide between the headlands, which are bluffs about 100 feet high; within the entrance the banks

converge quite rapidly, and about 4 miles from the mouth the river is about ¾ mile wide.

The *Albatross* anchored in 6 fathoms about 6 miles 247° true (SW mag.) from Cape Suworof, the water shoaling rapidly to 3 fathoms toward the mouth of the Kvichak River.

KVICHAK BAY AND RIVER.

The large arm at the head of Bristol Bay, extending northeast and bounded on the south by a line from the south entrance point of Ugaguk River to Etolin Point, has been designated as Kvichak Bay. The upper part of the bay is very shoal, and, as the current is strong, it can be safely navigated only by small vessels built to resist the shock of repeated grounding. It is said that the banks from the Etolin side project halfway across the bay, and, with those from the peninsula side, confine the channel to a comparatively narrow limit; a seagoing vessel, however, under skillful guidance and with local knowledge, may reach a point a few miles below the mouth of the Naknek River, which is about 30 miles below the head of the bay; but some cannery men consider the risk too great to carry their transport vessels to this point and leave them there for the season.

Above the mouth of the Naknek River the shoals begin to extend across the channel, and, as a point higher up is reached, the whole bay at low water is filled with uncovered banks, having shallow, narrow channels winding through them.

At the head of the bay is the mouth of Kvichak River, which is the outlet to the great lakes, Iliamna and Clark, lying on the western side of the mountain system bordering Cook Inlet.

This region has become an important one in recent years on account of the rapid development of the canning industry. There are at present 19 canneries and salting stations in Kvichak Bay.

The following information was furnished in 1916 by the Alaska Packers Association:

Tides.—The rise and fall of tide at the Alaska Packers Association's Kvichak cannery is normally about 24 feet and the June spring tides about 28 feet. These figures are approximate only, there being no available data on tides at this point.

Weather and ice.—The weather, during the operating seasons from May to September, for the years 1912 to 1915, was very mild and no ice pack was encountered by the vessels en route to this district. However, ice is sometimes encountered in Bering Sea soon after passing through Unimak Pass. At times this is quite extensive, and if held by the winds will cause considerable delay to vessels in reaching anchorage in Kvichak Bay. In 1911, the last season during which there was any extensive ice pack, vessels were unable to proceed from the ship anchorage off Naknek River toward Kvichak River until June 1, as the ice had not broken up in the river until that date.

Currents.—The current in Kvichak Bay and River is very strong, and as a consequence the channel shifts more or less each year.

There is but slight variation from year to year in the approaches to the ship anchorage off the Naknek River, and after passing this anchorage the land is low and flat on both sides of the bay with no distinguishing marks that would be of any aid to navigation.

On account of the method of fishing by means of drift nets, buoys would be a constant menace to the gear; and no navigation aids are maintained by any of the companies operating at this point.

Pilots.—Competent pilots can be obtained by sending a wireless message to any of the cannery stations operating in this district.

Beyond **Cape Suworof** the bay is obstructed with shoals and the channel becomes very narrow and tortuous. At low water only about 3 feet can be carried through. At or near high water, vessels of more than 12 feet draft would find it difficult to use the channel. Vessels of 14 feet draft have ascended the Kvichak River as far as the mouth of the Alagnak River. In this reach there are only three places where a vessel of 200 feet or less in length may anchor. The first is at Graveyard Point; the second is near the mouth of Jensen Creek; and the third is between the upper cannery of the Alaska Packers Association and the mouth of the Alagnak River.

Directions.—With Cape Greig, just north of Ugashik, bearing 112° true (E mag.), distant 25 miles, the course to the anchorage is approximately 39° true (N by E ½ E mag.). Follow this course carefully, using the lead when closing in with the land, until 4 miles beyond Johnstons Hill, where anchorage should be obtained 5 miles offshore in 7 to 8 fathoms at low water.

The first vessels arriving in the spring should feel their way with the lead and locate their position when anchoring. Vessels arriving after about May 15 will have no difficulty in obtaining a suitable anchorage, as there are always a number of vessels in the bay by that time.

Kvichak River from Kogiung to Iliamna Lake is 50 miles long. In the upper half of its course it has a current of 3 to 6 knots, and is much broken by islands and bars into narrow, shallow channels. The lower half is tidal.

The river is navigable by cannery tenders for about 22 miles above Kogiung, and by launches and Columbia River boats (when favored by strong winds) for its entire length.

Iliamna Lake is about 70 miles long and generally from 7 to 17 miles wide. It is about 50 feet above tide water. Reported soundings indicate a depth, at the east end, of many hundred feet.

The lake is usually frozen from late in December until late in May. The snow usually leaves the low ground in April, remaining until June in the pass between Iliamna Bay and Iliamna. Some snow may be expected in September, but the ground is not permanently covered at low altitudes until some months later.

Iliamna is the largest settlement. It is situated on Iliamna River, 3½ miles above its mouth, and 10 miles from Iliamna Bay. It has a United States commissioner, a Government school, and three stores.

A good horse trail leads from the head of Iliamna Bay to Iliamna, a distance of 10 miles, crossing a 900-foot summit 3 miles west of the bay. Another trail leads from the head of Cottonwood Bay to Iliamna, 17 miles, crossing three summits 1,700, 1,500, and 1,975 feet high, at 3½, 5, and 13 miles from Cottonwood Bay, descending to 1,400 and 600 feet between the summits. These trails can generally be used by horses from June 1 to November 1. Dogs are used during the remainder of the year.

Iliamna can also be reached by a portage from the head of Kamishak Bay to the head of Kakhonak Bay. This portage is said to be

an easy one over a low pass, but it is not much used except by natives, because of the difficulty of landing supplies on the uncharted coast of Kamishak Bay.

From Iliamna all parts of Iliamna Lake and Kvichak River can be reached in boats, there being several large sailboats and a gasoline launch at the village.

Newhalen River is about 20 miles long. The upper 10 miles can be navigated by canoes and poling boats. Rapids and reported falls make even canoe navigation impossible for the lower 10 miles. These rapids may be avoided by a 5-mile portage.

Lake Clark is about 45 miles long and from 1 to 3½ miles wide. It is about 220 feet above tide water, and is tributary to Iliamna Lake and Newhalen River.

NUSHAGAK BAY AND RIVER

are important on account of the extensive salmon fishing and a number of large canneries which are operated during the summer. The entrance of the bay is on the north side of Bristol Bay, between longitude 158° 18′ and 158° 40′ W. It is 15 miles wide at the entrance between Protection Point and Etolin Point, and extends about 12 miles in a northwesterly (mag.) direction to Ekuk, where it is 7 miles wide. Here it turns to a northerly (mag.) direction for 9 miles to Nushagak, where it is about 3 miles wide. The surveys extend from the entrance to the mouth of Wood River, the results of which are shown on chart 9050.

Nushagak Bay and River so far as surveyed are obstructed by extensive shoals near the shores, and by long bars, partly bare at low water, which generally extend in the direction of the channels. In the absence of aids, navigation is safe only in the daytime, when the marks, some of which are distant peaks, can be seen. The worst dangers in the approach are the extensive shoals southward and southeastward of Cape Constantine, the outer one being nearly out of sight of land.

The peninsula of **Cape Constantine** is low, rolling tundra country, with bluffs in places, the greatest elevation being shown on the chart. **Nichols Hills**, 125 feet high, are small sand knolls, the highest part of a ridge that follows the eastern side of the cape, and lie 5 miles northwestward of Protection Point. At the southwest end of the cape (lat. 58° 26′ N) and on the southeast side of the cape (lat. 58° 25′ N) are the entrances of two lagoons that can be entered by boats at high water when there is no surf.

Shoals with little water on them in places extend 6 miles southward from Cape Constantine, and the outer shoal (Ustiugof) lies 8 to 9 miles southeastward from the cape. These shoals are in the form of long ridges trending in the direction of the set of the tidal currents around the cape to and from Nushagak Bay. They are steep-to, especially on the off-shore side, and the lead will not give sufficient warning to avoid them. **Ustiugof Shoal** is a narrow ridge with a least depth of 13 feet, and has a length of 8 miles in a 52° true (NNE ¾ E mag.) direction with depths less than 4 fathoms. Its southern end lies in lat. 58° 14.5′ N; long. 158° 46′ W. There are depths of 11 fathoms or more close to its southeast side. From a vessel near the shoal Cape Constantine can be seen in clear weather, but the

greatest care is required when southward or southeastward of the cape and in sight of it. The shoaler ridges are generally indicated by rips, or breakers at low water, but there is generally nothing to indicate Ustiugof Shoal.

Protection Point, the eastern end of Cape Constantine, is a low marshy spit which extends 1½ miles from the higher land. There is the entrance of a lagoon on the north side of the point 2 miles westward of its end, which is closed at low water, but at other times boats can enter, although the current is strong on the ebb. A narrow shoal awash in places at low water extends 4¼ miles southward from the point, its southern half lying about 1 mile from shore; there is a narrow channel for boats between the point and the north end of the shoal. A detached shoal with 15 feet on it lies 2 miles eastward from the point.

The low spit eastward of Nichols Hills forms a cove, dry at low water, that can be entered by boats at high water and affords shelter except with northerly winds.

Igushik River has three salteries on the west side near the entrance, and vessels up to about 24 feet draft have been taken out. The channel into the river is not surveyed. The flat on the eastern side of the channel leading to the mouth of the river shows for nearly its full length at low water. The bar at the entrance of the channel has a depth of 12 to 14 feet on it, and lies about 7½ miles southeastward of the mouth of the river and 8¾ miles northward from Protection Point.

Igushik Ridge, on the west side of Igushik River, is prominent, having a greatest elevation of about 260 feet near its northern end, where it breaks sharply to the river. The peninsula eastward of the river is low, and on its eastern side is a slatted beacon, upper half black, lower half white. The range of the beacon and the summit at the north end of Igushik Ridge marks the turning point for the crossover southwestward of Ekuk.

Snake River is not used except by fishing boats. The channel leading to the mouth of the river has a depth of about 8 feet, and is well defined at low water by the flats, which uncover, except at the entrance, the latter lying about 3 miles northeastward of the beacon described in the previous paragraph.

The land on the eastern side of the bay is low, rolling tundra, and the entrance point is rounding without a distinct point. **Etolin Point** is here applied to the middle and highest one (elevation 90 feet) of three prominent bluffs, 1 to 1½ miles apart. A rounded hill about 150 feet high lies 1½ miles northeastward of Etolin Point, and is one of the first summits to show when approaching. A higher ridge lies 1½ miles farther inland, but neither is prominent.

The 3-fathom curve lies 6½ miles, and the 5-fathom curve 8 miles, from the shore southeastward of Etolin Point. The shoaling is gradual, and the lead is a good guide in approaching the eastern shore when outside of a line joining Etolin and Protection Points. Above this line there are long shoals, most of which show in places at low water, in the eastern half of the bay.

Ekuk Bluff is 170 feet high and is prominent from Nushagak Bay. A spit extends 1¼ miles northward from the bluff. **Ekuk** is a native village on the spit at the foot of the bluff, and there is a cannery on

the north end of the spit. The lagoon inside the spit is bare at low water.

Clark Point is low and is marked by two canneries and a high water tank. A ridge, 150 feet high with a bluff at the water, lies ⅝ mile southward from the point and is the prominent feature from the bay.

Clark Slough, 1½ miles northeastward of Clark Point, is navigable for launches about 17 miles at high water. The bar at its entrance has a depth of about 3 feet at low water. There is a cannery on the northern side at its entrance.

Nushagak post office is on **Nushagak Point,** 6½ miles northward from Clark Point. There are two canneries, a school, and Russian church. The point is a prominent ridge 250 feet high, eastward of which is a deep valley. On the eastern shore 2 and 5 miles northward of Nushagak are a disused cannery and a native village.

The western shore from **Coffee Point** to **Snag Point** is generally a line of bluffs. **Dillingham** post office, a native village, and a cannery are on **Bradford Point** abreast **Williams Island,** the latter grassy and awash at highest tides. The Government courthouse is at Dillingham. There are two canneries and a high tank west of Snag Point.

Wood River has its entrance northward of Snag Point, and has a length of about 24 miles to **Aleknagik Lake.** Its width varies from about 600 yards in its lower part to about 50 yards where it joins the lake. A depth of 3 to 3½ feet at low water can be carried 15 miles up the river and not more than 2½ feet to the lake, though at high water 4 feet can be carried this distance. The lake is about 24 miles long. There is a cannery on the south shore, just inside Snag Point.

Prominent features.—Northward of the bay is a chain of prominent mountains, some of which are described in the sailing directions. They are snow covered in early summer, but bare except in the ravines by the middle of July. In clear weather the peaks show from a long distance seaward, but much of the time they are obscured by clouds and haze. Many of the summits are shown on the chart.

Channels.—The channel generally used is near the middle of the bay, and leads in a depth of about 16 feet over the "outer bar," lying 7 miles 203° true (S ⅛ W mag.) from Ekuk Bluff. Southwestward of Ekuk the channel crosses the bay over several bars where there are depths of 12 to 14 feet. It then follows the eastern shore to the anchorage off Clark Point. The deepest draft of the cannery vessels entering the bay is about 24 feet.

The channel on the eastern side above Clark Point shoals gradually to 8 feet at Nushagak.

The channel to the canneries on the western side crosses the river at Clark Point, where the depth is about 12 feet, and follows the western shore above Coffee Point at a distance of about ¼ mile.

Anchorages.—There is no anchorage in the outer bay sheltered from all winds. In southwest weather the western side of the bay should be selected, and in northeast weather the eastern side. With winds from east to south (mag.) there is no shelter, and a heavy sea makes into the bay. The strong current causes a vessel at anchor to lie stern or broadside to the sea when the wind opposes the current. The bars seem to afford little protection. In northerly weather any part of the bay is sheltered, but the wind does not appear to blow with force from that direction during the summer.

There is good anchorage, sheltered from southwest winds, for vessels of 12 feet or less draft 1 mile 21° true (N mag.) from Protection Point in about 3½ fathoms. Deeper draft vessels should anchor farther northeastward.

Above Ekuk Spit good anchorage will be found wherever the depth will permit. The cannery vessels are anchored or moored off their respective plants, except those at Nushagak, which are anchored in the channel between it and Clark Point. This part of the bay is very choppy in heavy weather, but the sea seldom, if ever, is heavy enough to endanger a vessel. The bottom is sand, but the anchor holds well if given sufficient scope, say 60 fathoms. The currents are strong, and care should be taken to avoid dragging. Vessels remaining long are anchored in line in the channel to interfere as little as possible with the nets.

Supplies.—The nearest point at which coal can be purchased is Unalaska. Some provisions can be obtained at the companies' stores. Fresh meat is not generally obtainable, and game is scarce. Plenty of fish can be had during the season. Fresh water can be boated off from the cannery wharves. The cannery launches and tugs go to the wharves at high water. That part of the cannery wharves extending beyond high water is removed during the winter. The water is fresh at some of the river mouths on the last of the ebb, but it is too muddy for boilers or drinking. Northward of Dillingham there is a sparse growth of timber, which becomes heavy farther inland. Southward of Dillingham there are only occasional clumps of alder bushes.

Repairs.—The large tides and flats make it easy to beach a vessel of moderate draft (say 18 feet). A good place is at Clark Point just above the cannery. Small machine repairs can generally be done at the companies' shops.

Communication.—The mail schedule is monthly, by steamer during the summer from Seward by way of Unalaska, and in winter from Katmai by dog team. Some of the canneries have communication by telephone, and there are radio stations at Clark Point and Nushagak. There is little travel in summer except by boat on account of the soft tundra country and numerous lakes. There are some small native villages above Ekuk, and a few white men remain during the winter.

Weather.—The weather is variable, but it is considered better than farther westward. Spells of bad weather occur, and their duration increases in the late summer. In August and September, 1909, there was much stormy weather. Southwesterly winds predominated in the early summer, and easterly winds later.

Easterly winds bring thick weather and rain, and are accompanied by low or falling barometer. Southwesterly winds, if moderate, bring fair weather, but if strong, bring rain. Northwesterly winds bring fine, clear weather, but seldom blow steadily. In settled weather the wind may be light from any direction, accompanied by showers. After a gale there is usually no shifting of the wind or sudden breaking of the storm, but the wind decreases, and there is a gradual return to fair weather.

Fog sometimes sets in from sea, but there is little fog during the summer.

Ice.—Nushagak Bay is usually open to navigation the latter part of May, but the movement of the ice is variable, depending on the direction of the wind. Northeast winds drive it out of the bay. It is stated that the arrival of the cannery vessels has been as late as June 17. The cannery vessels leave Bristol Bay the latter part of August, the pack having been completed. It is not known when ice begins to form, but it is probably late in the fall.

Tides are influenced to some extent by strong winds. The currents have considerable strength, the ebb being the stronger, on account of the discharge from the rivers. The maximum ebb current observed is 3.8 miles, and flood, 2.9 miles. The ebb usually begins shortly before high water and continues to run after low water, roughly about 6½ hours ebb and 6 hours flood. The period of slack water is usually short. The currents generally set fair with the channels, but in navigating the bay the course is often across the current, and allowance must be made for it.

Currents.—The currents follow in general the direction of the channel; the velocity is influenced by freshets and continued winds, which also affect the times of slack water. A current of over 5 knots may be experienced at times.

NOTE.—The times given in the Tide Tables for Kodiak are expressed in one hundred and fiftieth meridian time; while the time used locally is one hundred and sixty-fifth meridian time; the following figures applied to the Kodiak one hundred and fiftieth meridian time gave the time of slack water or strength of current in one hundred and sixty-fifth meridian time direct.

Off Protection Point.—The mean velocity of the current at strength is 2.2 knots on the flood and 3 knots on the ebb. Slack water before the flood occurs at the time of low water at Kodiak, and slack water before the ebb 30 minutes before the time of high water at Kodiak.

Off Etolin Point.—The mean velocity of the current at strength is 2 knots on the flood and 2.5 on the ebb. Slack water before the flood occurs 30 minutes after the time of low water at Kodiak, and slack water before the ebb at the time of high water at Kodiak.

Off Clark Point.—The mean velocity of the current at strength is 2.3 knots on the flood and 3.2 on the ebb. Slack water before the flood occurs 1 hour 20 minutes after the time of low water at Kodiak, and slack water before the ebb 40 minutes after the time of high water at Kodiak. In three days observations, 2.5 knots was the greatest flood and 3.8 the greatest ebb current observed.

Off Coffee Point.—The mean velocity of the current at strength is 2.5 knots on the flood and 3.4 on the ebb. Slack water before the flood occurs 1 hour 50 minutes after the time of low water at Kodiak, and slack water before the ebb 50 minutes after the time of high water at Kodiak.

Between Clark and Coffee points.—The greatest strength of the flood or ebb occurs 4 hours after the time of low water and high water at Kodiak, respectively.

Off Dillingham.—The mean velocity of the current at strength is 2.3 knots on the flood and 3.2 knots on the ebb. Slack water before the flood occurs 2 hours 20 minutes after the time of low water at Kodiak, and slack water before the ebb 1 hour 30 minutes after the time of high water at Kodiak.

DIRECTIONS, NUSHAGAK BAY AND RIVER.

The channels and bars are probably subject to constant change due to the action of currents, and to a smaller extent by the action of the sea. Changes of considerable extent are reported by those of long experience. A margin of safety should therefore be allowed for the soundings found by the survey. It is also well to remember that with a very low tide the water may fall as much as 2 feet below the plane of reference of the chart.

The navigation of the bay is not easy, and a stranger should proceed with great caution. Tide rips may be taken as good evidence of shoals. The shoals are long ridges trending in the direction of the set of the tidal currents, and a course should not be laid across the currents unless sure of the position, as the danger of stranding is greatly increased. A stranger, unless sure of his position, should navigate only on a rising tide.

It is recommended for vessels bound to Nushagak Bay to make Cape Greig, which is high and easily recognized, and then shape the course for the entrance, favoring the Etolin Point side in preference to the Cape Constantine side. The currents that may be experienced when crossing from Cape Greig are not known, but there may be considerable set. Great care should therefore be exercised in approaching the entrance, and the lead should be used constantly. The land at the entrance when first seen in approaching is indefinite, and presents no feature that can be readily identified.

Capt. McMullen, of the steamer *Dora*, makes the following suggestions for approaching Nushagak Bay: From Amak Island steer to pass about 10 miles off Port Heiden, as there are some large houses there which are easily seen over Chistiakof Island. A good departure can be taken from here in daylight, as the shore along the coast has no other landmarks to be taken as a guide. From Port Heiden run up along the coast until Cape Greig is abeam, distant about 10 miles, then haul up for Nushagak Bay, course 344° true (NW ⅝ N mag.); if the tide is ebbing allow about ¾ point to the right, and the same to the left if the tide is flooding. This course should lead to a position about 5 miles off Protection Point when abeam.

The usual route up Nushagak Bay is to pass 5 or 6 miles off Protection Point, where there is a black and white beacon about 30 feet high, and shape the course for a position with the highest part of Ekuk Bluff bearing 58° true (NE ¾ N mag.), distant 4½ miles. If the mountains northward are showing, the range of peak X in line with the point where the slopes of peaks T and S meet will lead to that position; the course on the range is 342° true (NW ½ N mag.), passing 5¾ miles off Protection Point, and the distance above Protection Point is 14½ miles. There is a break of considerable breadth to the right of the range peaks, between them and the prominent notched peak marked E on the chart. Peak X is the left one of a pair of sharp peaks, the right one being hidden behind S when on the range.

On this course the lead should be kept going constantly, not only to insure the immediate safety of the vessel, but also to pick up the 16-foot shoal which crosses the channel 10½ miles above Protection Point abeam. In thick weather, particularly, the identification of this shoal not only fixes the position of the vessel, but also shows how

much allowance must be made for current in running down, by log, the remaining four miles to the change of course. During the summer a spar buoy is usually maintained by the cannery people to mark the change of course from range A to range B.

In clear weather, by far the best method of navigating the bay is by means of horizontal angles measured with the sextant and plotted on the chart by means of the three-arm protractor. Capt. McMullen used this method in preference to any other, and commends it highly.

Follow the range 14½ miles above Protection Point until the prominent red water tank standing above the canneries just clear of the bluff at Clark Point shows in the middle of a deep depression in the ridge, 1¾ miles eastward of Nushagak Point. At this point the beacon on the shore eastward of Igushik River will be in line with the summit at the north end of Igushik Ridge, bearing 278° true (WSW ⅞ W mag.). The left end of the mountains northwestward will also be approximately in line with the north foot of Igushik Ridge.

Steer for the water tank at Clark Point on the range described in the preceding paragraph, course 32° true (N by E mag.), for 1 mile, crossing a bar with 12 to 14 feet over it, until the highest part of Ekuk Bluff bears 66° true (NE mag.). Then head for the bluff, taking care to keep the bearing on and not to be set off by the current, which leads across two bars in a depth of over 14 feet. Continue this course for 2½ miles until about 1 mile from the bluff. Then steer 344° true (NW ⅝ N mag.) for about 2 miles and pass ½ to ¾ mile off the spit northward of Ekuk Bluff. When the cannery at the north end of the spit bears 103° true (E ¾ N mag.), distant about 1 mile, steer 21° true (N mag.) for Nushagak Point and anchor ½ mile or a little less off the cannery at Clark Point, in 5 to 6 fathoms (low water).

Vessels can pass eastward of the outer bar by standing on the range of peak Z in line with the notch in peak E, bearing 346° true (NW ⅞ N mag.), until the left summit of a saddle peak (the last toward the left of the distant high mountains) is in range with the north foot of Igushik Ridge, bearing 287° true (W ⅜ S mag.), being careful not to overrun. Stand on the latter range 1½ miles until on the range of peaks X, T, and S of a preceding paragraph. The 346° true (NW ⅞ N mag.) course leads about ½ mile westward of a bar which shows about 6 feet at low water, the course being changed when abreast its northern end. By this route vessels can proceed to an anchorage below the upper bars at low water, from which it is not difficult to get in when there is sufficient depth on the bars.

Clark Point to the upper canneries.—From Clark Point the channel crosses the bay, where the least depth is about 12 feet, and then follows the western shore above Coffee Point at a distance of about ¼ mile. Above Coffee Point the channel is narrow in places, with steep slopes and very shoal water on both sides. It should be navigated with great caution by a stranger, and on a rising tide.

From a position ½ to ¾ mile off Clark Point steer 319° true (NW by W ½ W mag.), with the water tank in range with a small knoll (apparently a clump of alders) on the ridge astern. Hold the range for ¾ mile after peak C is in range with the highest part of a low bluff 3 miles above Coffee Point, bearing 2° true (N by W ¾ W mag.). Then steer 20° true (N ⅛ W mag.) for Bradford Point for 1¼ miles until Coffee Point bears 325° true (NW by W mag.), distant ¾ to 1 mile. Then steer 353° true (NNW ½ W mag.) for 1⅛ miles

to a position 500 to 600 yards from shore at the first break in the bluff ½ mile above Coffee Point.

For the next 3 miles the channel is about 300 yards wide. The mid-channel is generally ¼ mile from shore—a little more at the head of the bight 1½ miles northward of Coffee Point, and a little less at points ⅝ mile southward and the same distance northward of this bight. The channel is then about 1 mile wide to Bradford Point, and the western shore is clear if given a berth of ¼ mile.

Follow the western shore at Bradford Point at a distance of ¼ mile until about ½ mile above the courthouse, and then keep ⅜ mile from shore. Anchorage in 4 to 5 fathoms (low water) may be had about ¼ mile from the shore at the canneries southwestward of Snag Point. The shoal eastward of the channel above Bradford Point is eastward of a line from the courthouse to the high tank at the cannery above, bearing 41° true (N by E ¾ E mag.).

Peak C is a sharp peak at the western end of a low detached mountain ridge, and is the first mountain to the left of peak B, which is the most conspicuous toward the head of the bay. In making the turn 2 miles southward of Coffee Point it should be noted that the prolongation southward of the shore from Coffee Point to the bight 1½ miles above intersects the range over the water tank on Clark Point at a point near the flat bare at low water that makes out from the western shore.

CAPE CONSTANTINE TO CAPE NEWENHAM.

The area between Cape Constantine and Cape Newenham is unsurveyed, and there are indications that the present charts are considerably in error. Vessels laying a course from outside Ustiugof Shoal to pass about 2 miles off Cape Peirce, in thick but otherwise moderate weather, have reported making Hagemeister Island right ahead. This may be due either to a northerly set in this vicinity or to errors in the chart, or, more probably, to a combination of both. In the thick weather which constantly prevails in this locality safety is assured only by constant use of the lead.

Walrus Islands are three islands and three rocks, all above water, extending 16 miles east and west and about 6 miles north and south.

Round Island, the easternmost of the group, is nearly 2 miles long, ¾ mile wide, and about 800 feet high, its west end being in latitude 58° 35′ N, longitude 160° 01′ W.

Crooked Island is between 4 and 5 miles in length and 2 miles in greatest width. The eastern part is rather low, but toward the western extremity the elevation is nearly equal to that of Round Island. There is quite a large bay on the northeast side, but it was not examined.

High Island, the westernmost of the group, is 4 miles in length, about 1 mile in width, and 900 feet or more in height.

The Twins are two isolated rocks 4 miles southward of Crooked Island, the larger 300 and the smaller 100 feet in height.

Black Rock, about 150 feet high, lies 1 mile northward of the southeast end of Crooked Island.

No other outlying dangers were seen in passing between the islands and the mainland. From 6 to 10 fathoms were found abreast the group, the depth gradually decreasing to 3 fathoms off the north end

of Hagemeister Island. The course was near the shore, however, and more water would doubtless have been found in mid-channel.

Hagemeister Island lies 9 miles west of High Island and is 14 miles in length and 8 in width. It is mountainous except for about 5 miles at the north end. Shoals surround the island and extend eastward 20 to 25 miles, including the area between Hagemeister and the Walrus Group.

Hagemeister Strait is about 16 miles in length and lies between the island of that name and the mainland. It is 3 to 4 miles wide, but shingle spits contract it in two places to less than 2 miles. On a passage through the strait made by the Fish Commission steamer *Albatross* the least water found was 4½ fathoms. Good anchorage was found under Tongue Point, the shingle spit making out from the mainland about midway of the channel. From the above anchorage the *Albatross* stood directly to sea, passing within a mile of the southwestern extremity of Hagemeister Island; thence 206° true (S ½ W mag.), shoaling the water to 3 fathoms 7 miles from the island. Greater depths might possibly be found by taking a more westerly course. It is reported that there is anchorage under the spits at both ends of Hagemeister Island. The tidal currents are very strong through the channel. The vessel was visited by a number of Eskimos while at anchor under Tongue Point.

Cape Peirce is of moderate height and symmetrical form. Depths of 10 fathoms are found 2 miles southward of the cape, and good anchorage in 10 fathoms of water is found inside Shaiak Islet (lying just eastward of the cape).

There are reports of good anchorage, sheltered from northerly weather, in the bight northwestward of Cape Peirce.

The same report states that a shoal area makes off westward (true) from the cape, having depths of from 2 to 3 fathoms. The extent of this shoal and the least water to be found on it are unknown. To make the anchorage from eastward, give Cape Peirce a berth of about 3 miles, and steer 9° true (N by W mag.) for the junction of the northwest end of the sand beach with the rocky shores, and select anchorage at will off the sand beach. The approaches from westward are clear except for the shoal above mentioned.

KUSKOKWIM BAY AND RIVER,

from Cape Newenham to Bethel, are shown on charts 9103 and 9104.

Cape Newenham is the landfall for this region, and can be approached close-to with deep water. It is the end of a peninsula formed by a series of rough saw-tooth mountains. These mountains terminate in a level plateau which forms the immediate cape. In southerly weather a heavy sea and tide rips occur off Cape Newenham.

Jagged Mountain is a well-defined peak, the highest of the Cape Newenham group. Viewed from northward its slopes appear jagged.

Security Cove, 9 miles northeastward of Cape Newenham, is a good anchorage except with northwest winds; the usual summer gales are southeasterly. The bottom is even and shoals gradually. The best anchorage is about ¾ mile northeastward of Castle Rock, on the range of Castle Rock and the first rocky promontory southwestward, in 3½ fathoms, mud bottom. Fresh water can be procured from a stream which enters the cove.

There is also good anchorage in the middle of the small bight on the southwest side of Castle Rock, in 3½ fathoms, good holding ground. This anchorage is less affected by the ground swell making along the coast from Cape Newenham than the anchorage in Security Cove.

Castle Rock, the southwest point of Security Cove, is a small, prominent headland, 299 feet high, joined to the land by a low neck.

At the northeast point of Security Cove there is a conspicuous pinnacle rock, 169 feet high and covered with light tundra.

Chagvan Mountain is a smoothly shaped mountain terminating in two rounded knobs about 1,540 feet high, which lies between Security Cove and Chagvan Bay.

Chagvan Bay has a narrow shoal entrance. Inside it is very shoal and cut up by bars that are bare at low water.

Red Mountain is a conspicuous reddish-colored mountain just south of Goodnews Bay. From northward it appears as a long ridge with the highest part at its northern end.

Goodnews Bay is shoal except for the deep channel which leads through the entrance and for a distance of about 1 mile inside. This channel affords good anchorage, the best place for vessels being in the middle of the entrance; small craft can select a berth from the chart that affords the best shelter. The sea from outside is broken by the shoals off the entrance and does not reach the anchorage. With southerly or easterly winds tide rips, dangerous for boats, occur in the channel. The spits at the entrance are of shingle and steep-to. Fresh water may be had from a small stream near Baluka Hill.

Shoals extend 2½ miles off the entrance of Goodnews Bay. In 1914 the channel with best water led across the shoals from southward, and had two bars, with a least depth of about 10 feet, 2½ and 3½ miles southward of the entrance. The following directions led through the channel: Bring the inner shore of the north spit just open from the west shore of the south spit, and stand in on this range, course 17° true (N ¼ W mag.), until across the bars. Then follow the south spit at a distance of ¼ mile, and cross the entrance to a position 300 yards eastward of the north spit. A 56° true (NE ¾ N mag.) course with the south side of the north spit astern will then lead in the channel through the bay for a distance of over 1 mile.

Mumtrak is a small native village at the head of Goodnews Bay, and can be reached by small craft only, owing to the extensive mud flats. Two small creeks enter the bay, one on each side of the village. There is a Government school and a native trader at Mumtrak.

Baluka Hill is a prominent conical hill 886 feet high, with a steep, rocky face that rises abruptly from the north side of the bay. Although lower than the mountains behind it, Baluka Hill usually stands out prominently from all parts of Kuskokwim Bay.

It is reported that a cannery is to be established in Goodnews Bay at the foot of Baluka Hill. To reach the vicinity, the following courses are recommended:

After rounding the north spit at a distance of 300 yards, steer 312° true (WNW mag.) for the high bluffs on the west side of the bay. Hold this course for about 2 miles, or until the eastern side of Baluka Hill is in range with the flat-topped mountain just back of Mumtrak village. Then head up for Baluka Hill and hold the range until up to the anchorage under the mountain.

About 6 feet of water will be found here at low tide. In 1913 the surveying steamer *Yukon* lay at anchor here during a northerly gale. There is no protection in southerly or easterly weather. A fine stream enters the bay here, and there is a good shingle beach.

It should be noted that this route has not been surveyed, and that there may be, in places, less than 6 feet at low tide. It should therefore be used with caution, with the lead going constantly, and only on a rising tide.

Carter Spit is a low sand spit about 4½ miles long and from 50 to 300 yards wide. A white painted beacon, 35 feet high, stands on the spit 1 mile south of the elbow. Carter Spit incloses Carter Bay, which is a wide area of shoals and mud flats. Around the end of the sand spit there is a narrow channel scoured out, affording an anchorage for launches and small craft. There is no protection from northward. A small stream, known as **Indian Creek**, flows into the east side of Carter Bay near two abandoned cabins, formerly called **Carter**. Fresh water can be obtained by boats from Indian Creek at high water.

Explorer Mountain is the highest peak northward of Goodnews Bay. From southward it appears as a long ridge, and is recognized by three deep gulleys on its side. From westward it appears as a pyramid peak, the highest of the group.

Tooth Mountain is a flat-topped mountain in the front range, and has a sharp, rocky pinnacle on the northern edge of its summit. It is easily recognized from the vicinity of Carter Spit.

Figure IV Mountain is a sharp peak in the front range eastward of Jacksmith Bay. The deep ravines on the side of this mountain form a perfect IV, which is conspicuous from westward when the ravines are filled with snow. In the latter part of the summer the snow disappears from the ravines.

Cone Mountain is a large conical mountain in the first range.

Yukon Hill is low, but is the north end of the front range paralleling the coast, and is visible from the entrance of Eek Channel. From westward it is not distinguishable, as it has the receding range as a background.

Thumb Mountain is a fairly sharp summit in the range which recedes from Jacksmith Bay. From off Quinhagak it resembles a huge thumb placed on a high flat mountain plateau. As Eek Island is approached the mountain appears as a ridge and is not so distinctive.

Jacksmith Bay is the large indentation 14 miles northward of Carter. It is entirely bare at low tide.

Quinhagak P. O. is almost inaccessible by water because of the great mud flats bordering its shores. Launches can enter the creek here only at the highest tides, and even small craft can hardly get within sight of the village and remain afloat at low water. Supplies are landed with great difficulty, owing to the extensive flats and their exposure. There is a Moravian mission, a store, and a Government school, and a limited amount of supplies may be procured. The church steeple is sometimes visible from Eek Channel. The Kanektok River here runs fine clear mountain water at all stages of the tide.

Warehouse Bluff is a long dark-colored bluff about 12 miles northwestward of Quinhagak. This is an important landmark, as it is the first land on the east bank to be sighted when ascending Eek Channel. No objects on the west shore are visible until approaching the head

of Eek Channel. A square tower beacon 25 feet high has been erected on the highest part of the bluffs.

Warehouse Creek is a deep creek about 2 miles above Warehouse Bluff. It is approached through a long tortuous channel through the mud flats that can be followed by small craft when the flats are bare. Small craft may find shelter here. The greatest range of tide in the bay occurs in the vicinity of Warehouse Creek. Inside the creek there is just swinging room for a 75-foot vessel riding to 15 fathoms of chain.

Kuskokwak Creek flows into the east side of the river about 4 miles southward of Beacon Point. It is approached through a short channel across the flats and affords a good shelter for launches and other small craft. There is a depth of 4 fathoms just inside the mouth of this creek.

Beacon Point is generally considered the mouth of the river. Two range beacons are built on this point. The rear one is a 30-foot square tower and the front one is a low tripod. They mark the cross-over from Eek Channel.

Popokamute is a large native summer village on the west bank at the mouth of the river just across from Beacon Point.

Eek Island is a grass-covered mud flat cut up by deep sloughs, and is covered by the higher tides. Eek Island affords a feeding ground for many thousands of ducks and geese.

West Point is the local name given the fishing camp on the west bank of the river just above Eek Island. The native pilot "Capt. John" lives near here, and "Moses" is often found at the fishing camp.

Eek River is a large tributary flowing into the Kuskokwim on its eastern side just above Eek Island. It is navigable by launches for 15 or 20 miles. The river rises in the mountains about 60 miles distant, but its waters are muddy and full of silt.

There are a number of small native villages on the river between West Point and Bethel.

Bethel is considered the head of ocean navigation. There is a Moravian mission, a sawmill, and two or three stores located here. Here the Kuskokwim Commercial Co. has a large warehouse with rock-filled cribs to which vessels can moor and discharge. The range of tide here is only about 3 feet, but the stage of the river has considerable influence on the depths. During the summer a river steamer is operated from Bethel to **McGrath**, a distance of about 550 statute miles.

Mail facilities.—The mail for the lower Kuskokwim comes monthly by the way of the Yukon and Holy Cross Mission. It is transported over the portage to the Kuskokwim and carried down that river in small boats as far as Quinhagak. Power schooners from Seattle also carry mail when practicable.

Pilots.—There are two native pilots who know the river above Eek Island. They are known locally as "Moses" and "Capt. John." "Capt. John" lives on the west side of the river just above Eek Island, and "Moses" is usually found at his house on the east bank near the wrecked schooner *Volante*, abreast the upper end of Eek Island. On the appearance of a vessel, one of these natives usually puts off to engage himself as pilot. There is no established fee.

Currents.—The currents of Kuskokwim Bay and River are strong. A strong tidal current sweeps past Cape Newenham, setting approxi-

mately north and south true, and another follows the shore along the north side of the cape. In general the currents set in directions parallel to the axis of the channels between the shoals. In the deep channels off Jacksmith Bay the flood current has a velocity usually of about 2 to 2½ knots at strength, and the ebb from 2½ to 3 knots. In the vicinity of Eek Island, the strongest ebb current observed was 3½ knots. Here the current turns from one to one and one-half hours after high and low waters. The flood current is felt only about as far as Bethel.

Ice.—The river is usually open for navigation about June 1, although ice conditions are uncertain and vary much from year to year. In the fall ice makes on the upper river in October, and heavy ice forms off Goodnews Bay in November. Goodnews Bay freezes over entirely in the winter.

Weather.—All reports agree that the best weather usually occurs in March and April of the early spring. During the summer southeast to southwest gales are frequent, lasting from two to five days. These storms gradually blow themselves out, and are generally followed by a few days of good weather. In the early fall northerly winds are frequent, and are usually accompanied by a clear sky. After the middle of September strong gales become frequent and prolonged.

Fresh water can be obtained from small streams in Security Cove, in Goodnews Bay near Baluka Hill, and from Indian Creek in Carter Bay. In the vicinity of Eek Island the river water is fresh at all stages of the tide. It is very muddy, but settles readily.

Tides.—In Kuskokwim Bay and River there are usually two unequal high waters and, to a much less extent, two unequal low waters during the lunar day, the inequality varying principally with the declination of the moon. About two days after the moon is on the equator the tides are generally nearly equal and have the least diurnal range. About two days after the moon reaches its greatest declination (farthest N or S) the tides are very unequal, and usually have the greatest range of the month; these are called "great tropic tides."

On account of the difficulty of determining accurately the tidal elements in this region, a special table of predicted times and heights of high and low waters for 1916 at Apokak is issued; but beginning with 1917 this information will be given in the General Tide Tables and Pacific coast reprint.

CURRENTS, KUSKOKWIM BAY AND RIVER.

Goodnews Bay.—The currents are strongest at the entrance, the maximum observed being an ebb current of 2.5 knots. During large tides, the ebb tide overran the flood by as much as 2½ hours. The strength of the current follows the channel toward Baluka Hill, causing a strong eddy to sweep around the northeast shore of the south spit. Here the current nearly always runs ebb and sweeps with great force during the runout. Tide rips were observed in and off the entrance, but they are dangerous for small boats only.

NOTE.—The time differences given in the following list are such that, when applied to the times of high and low waters as given in

the Tide Tables for Astoria, Oreg., the current will be given in one hundred and sixty-fifth meridian time.

Kuskokwim Bay and River.—The currents are swift and follow in general the direction of the channel. The strength of current and the time of slack water varies and may at times differ from the values given in the following list due to freshets and prevailing winds. Occasionally a current of 5 knots is experienced.

In the Channel, off the entrance to Goodnews Bay.—The mean velocity of the current is 2.5 knots at strength of ebb and flood, setting in a southwest and northeast true direction, slack water before the flood occurring 1 hour 10 minutes after the time of high water at Astoria, Oreg., and slack water before the ebb 1 hour after the time of low water at Astoria, Oreg.

In the Channel west of Carter Bay.—The mean velocity of the current is 2.3 knots at strength of ebb and flood, slack water before the flood occurring 2 hours 15 minutes after the time of high water at Astoria, Oreg., and slack water before the ebb, 2 hours after the time of low water at Astoria, Oreg.

In the Channel, southwest of Warehouse Bluff.—The mean velocity of the current at strength of ebb and flood is 3.3 knots, slack water before the flood occurring 2 hours 45 minutes after the time of high water at Astoria, Oreg., and slack water before the ebb 2 hours 45 minutes after the time of low water at Astoria, Oreg.

In the Channel off Apokak.—The mean velocity of the current at strength of ebb and flood is 3.4 knots, slack water before the flood occurring 3 hours before the time of low water at Astoria, Oreg., and slack before the ebb 2 hours before the time of high water at Astoria, Oreg. The strength of the flood current occurs 20 minutes after the time of low water at Astoria, Oreg., and the strength of the ebb current 1 hour after the time of high water at Astoria, Oreg.

DIRECTIONS, KUSKOKWIM BAY AND RIVER.

About 15 feet is the deepest draft that should attempt to reach Bethel, although a vessel drawing 16½ feet and traveling only at or near low water has ascended the river to that point.

The navigation of Kuskokwim River and its approaches is difficult. In the bay the shoals are generally hard and steep-to. In a southerly storm a heavy sea makes up the bay nearly to Eek Island, and vessels caught on a shoal are in danger of being pounded to pieces.

The lead is the navigator's best aid, and it should be kept going constantly on both sides of the vessel. No definite rules can be given for following the channels by the surface indications of the water. At certain times the channels will be smooth with rips on the shoals; but again for no apparent reason the indications may be reversed, with rips in the channel and a slick on the shoals. The edge of a channel is often marked by a long line of foam, although cases have been known where the line of foam extended across the channel. It is always well to approach such a line with caution.

Mariners are strongly cautioned against attempting to follow the channels in the bay at high water. Owing to the inequality of the tides, a vessel grounding at high water may not float again for several days. By waiting for low water the mud flats become natural aids instead of dangers.

Passing about 2 miles westward of Cape Newenham, make good a 28° true (N ¾ E mag.) course for about 6 miles until the cape bears 190° true (S ⅞ E mag.); then make good a 10° true (N ⅞ W mag.) course with Cape Newenham directly astern for about 18 miles until Baluka Hill bears 65° true (NE mag.) and Red Mountain 121° true (E by S mag.). From this position make good a 341° true (NW ½ N mag.) course for about 13 miles to a position 4 miles 256° true (SW by W mag.) of the elbow of Carter Spit, and 4½ miles 270° true (WSW ¼ W mag.) from the beacon on the spit.

In thick or hazy weather a route nearer the coast may be taken as follows: Pass ½ mile off Cape Newenham and Seal Rock, and then make good a 70° true (NE ½ E mag.) course for about 6½ miles until Castle Rock, the southwest headland of Security Cove, bears 177° true (SSE mag.). Strong tidal currents occur along the north shore of Cape Newenham. From this position make good a 357° true (NNW mag.) course with Castle Rock astern for 14 miles until the summit of Red Mountain is abeam; then make good a 341° true (NW ½ N mag.) course for 19½ miles to a position 4 miles 256° true (SW by W mag.) of the elbow of Carter Spit.

From a position 4 miles 256° true (SW by W mag.) of the elbow of Carter Spit make good a 302° true (W by N mag.) course for 5½ miles with Baluka Hill in range with Pyramid Mountain astern. This range should be held until the water begins to deepen after crossing the 8-fathom ridge shown on the chart. Then head up the channel on a 6° true (N by W ¼ W mag.) course.

Vessels should arrange to make this point at the last of the ebb tide, and go up the channel with the flood tide. After heading on the 6° true (N by W ¼ W mag.) course, the long shoal on the east side of the channel should be made out, either heaping or breaking. It is only with a very smooth sea that this shoal is not in evidence at low water. After continuing on this course for about 10 miles the long shoal on the west side of the channel should be made out, either heaping or breaking. This shoal should be followed at a distance of about 1 mile until its northern extremity is reached. Here it becomes a flat, bare at about half tide. It is of a yellowish color and has deep water close-to. This flat is the leading mark for entering Eek Channel, and therefore it should always be made at low water.

From here for about 15 miles the channel must be followed by the chart and the lead. The leads should be kept going on both sides of the vessel, as the slope at the sides of the channel is sufficient to make the difference in depth, obtained with the two leads, a warning of the approach to the flats. Near the edges of the channel the water usually shoals abruptly. In clear weather the white church steeple and buildings at Quinhagak may sometimes be seen from this channel.

Having arrived at a point in the channel from which Quinhagak bears about 99° true (E by N mag.), a black mud flat which is well bare at half tide should be made out ahead if the tide is not too high, and at the same time Warehouse Bluff should be picked up bearing about 37° true (N by E ½ E mag.).

Pass about ½ mile westward of this mud flat, and then follow the flats as indicated on the chart. This part of the channel is not difficult to follow at low water, but it is almost impossible to navigate it at high water when the flats are covered.

From the head of Eek Channel there are two channels that are used. For large vessels drawing 10 feet or more the channel westward of Eek Island should be used. The channel eastward of Eek Island is feasible for small boats only, owing to its narrow width and shoal places.

In case of vessels grounding on a falling tide, masters are warned against using their engines too long, as the silty bottom is apt to be sluiced out from under the stern of the vessel, with serious results when the tide falls completely.

To pass on the east side of Eek Island, favor the east side of the channel until on the Beacon Point range. This range has a 30-foot square tower for the rear mark, and a smaller tripod beacon for the front mark. Follow this range, which leads in a least depth of about 12 feet at low water, and enter the deep channel which follows the east shore of the river above Beacon Point. Follow the shore at a distance of about ¼ mile, until off the slough which lies about 1 mile north of Apokak village. From this point head about 304° true (WNW ¾ W mag.) and enter the channel which extends along the north side of Eek Island. This crossover has a least depth of about 7 feet, and is a difficult one to make. A power boat should be sent ahead to sound, as the channel is narrow and is apt to shift from year to year. If possible, a native pilot should be employed before attempting the crossover from Apokak.

The channel along the north side of Eek Island is easily followed until its west end is approached, as the deepest water is close to the shore. From a point about 100 yards off the northwest point of Eek Island, head for the large beacon at West Point on a 299° true (W ¾ N mag.) course. This leads over a shoal with a least depth of 5 feet at mean lower low water.

To pass on the west side of Eek Island, follow a mid-channel course up Eek Channel until on the Popokamute range, which consists of a 30-foot square tower for the front mark, and two smaller tripods for rear marks. When on this range the tower should appear midway between the two rear marks. If the proper course is followed up Eek Channel, the Popokamute range and the Beacon Point range should come on at the same time.

Head across on the Popokamute range 284° true (W ½ S mag.) for 1⅝ miles, or until the soundings show about 8 feet more water than was obtained at the shoalest place on the crossover. Then steer 180° true (S by E ¾ E mag.) for about 1⅝ miles, when the Beacon Point range should be on. Head across on this range 232° true (SSW ⅞ W mag.) and continue for about ⅞ mile, when the deep water of the West Channel should be reached. This range clears the long shoal that makes down the middle of the West Channel.

From this point steer a 332° true (NW ¼ W mag.) course, which should lead about ¼ mile off the tower beacon at Popokamute.

From Popokamute the west bank of the river should be followed closely for about 5 miles, then the course bears out into the river, passing midway between the west bank of the river and Eek Island.

From off Eek Island there are two channels which may be used in ascending the river. One of these channels follows the east bank and the other the west bank. Local knowledge, however, is necessary in following them. About 15 miles above Eek Island they unite,

and from this point the channel crosses many times from one side of the river to the other, and there are no prominent features which can be used as leading marks. One of the two pilots living in the vicinity of Eek Island should, therefore, be employed. Of the two channels above Eek Island, these pilots appear to know the western one better, and for that reason it is recommended.

PRIBILOF ISLANDS.

This group consists of St. Paul, St. George, Otter, and Walrus Islands. The two latter are small and uninhabited. St. Paul and St. George are important as containing the largest and most numerous seal rookeries of the world. These two islands are each in charge of a United States Government agent. Excepting vessels of the United States Government, all vessels are forbidden landing on these islands. United States naval radio stations are maintained on both St. Paul and St. George Islands. There are no harbors about the islands, and the anchorages are only available with the wind off the land. Because of the uncertain and shifting nature of the wind in this locality, vessels should always anchor with a view of getting underway quickly if necessary.

Fogs are especially thick and prevalent in this vicinity in the summer, and navigation is attended with difficulty and danger.

These islands are at about the southern limit of the ice in Bering Sea. Detached fields of ice will generally be found in their vicinity from February to May.

ST. GEORGE ISLAND

consists mainly of high volcanic hills and ridges, and its entire coast is a precipitous cliff except for a few miles on the north side and short intervals at Garden Cove and Zapadni Bay. The east and west extremities of the island, Tolstoi and Dalnoi Points, are bold promontories.

High Bluff, on the north side of the island, 1,012 feet high, is a prominent landmark, and is visible from St. Paul Island, a distance of nearly 40 miles, on a clear day. There are no harbors, but vessels anchor at North Anchorage, Garden Cove, and Zapadni Bay, according to the direction of the wind; the anchorages are poor except with the wind directly off the land. At a distance generally not greater than 2 miles from the island the depth of the water is but little less than the surrounding sea, and in thick weather it is not safe to depend upon soundings for picking up the land unless sure of the position. Vessels should not approach the island in less than 12 fathoms of water. There are no outlying dangers except the small reefs at Zapadni Bay and at North Anchorage. It is reported that vessels have found breakers, in very heavy weather, about 9 miles east of Tolstoi Point.

The anchorage in **Zapadni Bay**, on the southwest side of the island, in 10 fathoms of water, affords shelter with winds from east-northeast to north-northwest. The landing is on the open sand beach, and can usually be made with northerly winds. A reef extends about ¼ mile offshore southward of the anchorage.

With northerly winds, a landing may sometimes be made at **Garden Cove**, on the sand beach. The anchorage affords good shelter from

northwesterly winds, but with the exception of a small area the bottom is rocky.

At **North Anchorage** there are two houses on the beach, with a road back of them leading up the hill to the village. In approaching, get these two houses open and steer for them. Anchor in not less than 10 fathoms. A flag is shown from the flagstaff when landing is possible. The landing westward of the houses is a cutting in the rocks for small boats to enter at high or medium tides. It is somewhat protected by a ledge of rocks north of it, and by kelp, which tends to reduce the breakers. At East Landing, just northeast of the village, is a similar boat landing, but better protected from a westerly swell. A ledge of rocks awash lies a short distance off this landing. If desired, a boat will come out to vessels at anchor when landing is practicable.

Tidal currents.—The current sets eastward during the rising tide and westward during the falling tide, with a maximum velocity of 2½ miles. With opposing wind and current, tide rips occur off Tolstoi and Dalnoi Points. These rips are not heavy enough to be of any moment, except that to strangers they may appear to be breakers. The water off both points is deep, and they can be passed close-to with safety.

OTTER ISLAND

has an abrupt bluff at its southwest end, 288 feet high, slopes gradually to the north and rises again in a crater, 150 feet high, at its extreme east end. Foul ground, marked by kelp, extends about ¾ mile from the island on its south, southwest, and north sides. The north side, from Crater Point to Northwest Reef, is clear of dangers. Probably the best anchorage near the island is in 9½ fathoms, black sand and broken shells, with the northeast extremity of Crater Point bearing 185° true (S by E mag.), distant ½ mile. This island must be approached with great caution in thick weather, and at all times keep out of kelp. Between Otter Island and Reef Point, St. Paul Island, the tidal currents are strong, and with heavy winds dangerous tide rips occur, especially on the ebb.

WALRUS ISLAND

is low, about 39 feet above the water, level on top, and composed of irregular masses of volcanic rock. It is about ⅜ mile long and ⅛ mile wide. Anchorage can be had on either side of it, ¼ to ½ mile offshore, in 10 to 15 fathoms. Landing can be made with smooth water, the best place for this purpose being in a small cove at the southwest corner. The island is a bad place to make in a fog.

Parts of Otter and Walrus Islands are covered with sea birds in the breeding season, and at the proper time a plentiful supply of eggs may be obtained.

ST. PAUL ISLAND.

The west and southwest parts of St. Paul Island are high and mountainous, with precipitous cliffs at the coast. The rest of the island is a comparatively low, rolling plateau, with a number of extinct volcanic peaks scattered over its surface. **Bogoslof,** 590 feet high, a conical crater near the center of the island, and **Polovina,** a

double-peaked hill, 470 feet high, near its east end, are conspicuous, and are the best landmarks in clear weather when coming from southward. From this hill the island stretches away in a low, narrow neck to **Hutchinson Hill**, 100 feet high, on Northeast Point. West of Lukanin Bay the coast of the south side of the island is rocky, with bluffs at the points. The shore of the rest of the island is generally a sand beach, with rocks in the vicinity of the seal rookeries.

Dangers.—Kelp-marked reefs extend about ⅜ mile southeastward from the two low points lying ⅝ mile and 1⅛ miles southward of **Northeast Point.** A dangerous ledge, marked by kelp, lies 1 mile 355° true (N by W ⅞ W mag.) from Hutchinson Hill. It is about ¼ mile in diameter, and its least depth is found on two rocks with 3 fathoms over them. With a moderate swell the sea breaks over these rocks and for a short distance off Northeast Point. Depths of 8 to 10 fathoms can be carried between the ledge and Hutchinson Hill by keeping the shore aboard distant ⅜ to ½ mile.

The north coast from west of Hutchinson Hill to Southwest Point is free of dangers, no reefs or rocks until within ½ mile of the land, except off North Hill; but the bottom is uneven and rocky and the anchorage not generally good.

A rocky patch, with 7 fathoms water on it and 9 to 13 fathoms around, lies with Hutchinson Hill bearing 80° true (NE by E ¾ E mag.), distant 3⅛ miles. There may be less water on the shoal, as the locality was not fully examined.

Off **North Hill** a shoal extends about ¼ mile northward, the depths gradually increasing to 4 and 6½ fathoms at 1 mile from the coast.

A spot with 5 fathoms over it is reported 8 miles 272° true (WSW ¾ W mag.) from the west end of St. Paul Island. Kelp has been noticed in this vicinity.

Breakers extend ½ mile or more off **Southwest Point.**

A dangerous ledge, usually marked by breakers, extends ½ mile southwestward and southward from **Reef Point,** the south point of the island.

A reef extends about ¼ mile off **Tonki Point,** the northeastern point of Lukanin Bay.

The following beacons have been established on St. Paul Island: (1) On the southwest side of Zapadni Point, 70 feet high; (2) on North Point, 35 feet high; (3) on Sealion Point, 28 feet high; and (4) on Halfway Point, 29 feet high.

Anchorage.—The usual anchorage at this island is off the west side of Reef Point, and there is also an anchorage on the east side, off Black Bluffs. From the anchorage on the west side the village is hidden, but there is a flagstaff on the top of the hill overlooking the bay; from the Black Bluffs anchorage the village is in full view, and there is another flagstaff, the lower of the two, on this side. If a vessel is seen approaching, the United States ensign is hoisted on the flagstaff on the side on which she ought to anchor, and the ensign is kept flying if landing is safe, but hauled down if it is not safe.

Vessels should not attempt to ride out a gale at anchor near the islands, unless to leeward and well sheltered. The surf is apt to make quickly and is dangerous on the weather side of the island.

Landing.—In Village Cove, the landing place on the west side of Reef Point, the landing is just northward of the bluff point where the flag is hoisted; a bar extends across the entrance, on which the sea

breaks unexpectedly, and is often dangerous. Boats going in, after passing north of the point, must keep close in to the small point just outside the wharf. At low water boats can not land at the wharf.

The landing on the east side is a small cutting in the rocks, close to a salt house; with westerly winds and high water, landing here is easy.

A landing can sometimes be made at the head of the cove on the south side of Lukanin Bay, when impracticable at Black Bluffs or Village Cove.

Village.—The village is a number of small, wooden houses, painted white, with dark roofs, a church, also several large buildings for the Government agent. There are about 250 inhabitants. A naval radio station is located on the island.

Tides.—The mean rise and fall at St. Paul Island is 2.1 feet. Around St. Paul Island the flood tidal currents sets eastward and the ebb westward, following the trend of the shore. The greatest velocity occurs at Northeast Point and between Reef Point and Otter Island, and is 1 to 2 miles, but with continued strong winds from one direction it may be increased to 3 miles. There are heavy rips around Northeast and Southwest Points, also between Reef Point and Otter Island, where they are worst on the ebb. The tides and tidal currents are greatly influenced by the winds.

NUNIVAK ISLAND

is rarely approached by vessels. For a distance of 10 miles about the island, especially on its east and north sides, the bottom is reported very uneven, consisting of ridges with deeper water between. The island should therefore be approached with caution. From westward it presents gentle slopes, terminating seaward in reddish cliffs 150 to 462 feet high. The highest point of the western part of the island is 830 feet, which is found 10 miles eastward from Cape Mohican. Near the center there are some mountains of moderate height that rise with a gentle slope. Except some hills, the eastern end of the island is low. In clear weather the island can generally be made out at a distance of 30 miles from any direction.

In 1899 the U. S. S. *Corwin* cruised completely around Nunivak Island, following the shore and outlying islands at a distance of about 2 miles, and found general depths of 7 to 10 fathoms. The coast is generally abrupt and rocky, with numerous bights in which anchorage was found with 3½ to 7 fathoms of water.

Cape Mohican, the western point of the island, is in latitude 60° 12′ 45″ N, longitude 167° 27′ W, as determined by the Coast and Geodetic Survey in 1902, and is a narrow promontory about 2 miles long. The point of the cape is a cliff 266 feet high, from which it falls eastward to a height of 150 feet in a distance of 2 miles, and then rises by a gentle slope to the higher land of the island.

A dangerous ledge extends off Cape Mohican, probably 1 mile, though the distance is uncertain. Between 1 and 14½ miles westward of the cape the soundings show a somewhat irregular bottom with depths of 13 to over 23 fathoms. A shoal with 4½ fathoms over it is reported about 14 miles 271° true (WSW ½ W mag.) from Cape Mohican. It is reported that a reef exists 1½ miles north of Cape Mohican, and extends eastward about 3 miles; this reef was observed to be breaking along its entire length with a smooth sea. A shoal

with 3 fathoms and less is reported 5 miles 349° true (NNW ½ W mag.) from Cape Mohican.

A shoal with 9 feet over it is shown on the charts about 12 miles 46° true (NNE ½ E mag.) from Cape Mohican. A line of soundings with 12 to 13 fathoms was run by the *Manning* about 2 miles inside (southward) of this position, and another by the *Patterson* with 14 to 16 fathoms 1¾ miles westward of it.

From Cape Mohican the southwest coast extends with a slight curve in a southeasterly direction for 9½ miles to what may be called the southwest cape of the island. This stretch of coast is impassable cliffs 150 to 462 feet high, and there is no boat landing. The 6-fathom curve is about 1¼ miles offshore, and there are no known outlying dangers. An observation of the tidal current gave a maximum velocity of 1.2 miles on both flood and ebb; the flood sets northwestward and ebb southeastward alongshore.

The southwest cape of the island is cliffs 100 to 150 feet high, the summit of which is gentle slopes of tundra. The coast here changes direction gradually eastward for 2 miles to a small cove, which is the first boat landing southeastward of Cape Mohican. The best landing place is on the sandy beach in front of a small native village. Fresh water can be obtained from the stream just east of the village, which, at low water, is fresh to its outlet. A temporary anchorage may be made about ¾ mile off the entrance to the cove, in 7 to 8 fathoms.

From the southwest cape of the island the coast has a general 122° true (ESE ¾ E mag.) direction for about 21½ miles, and then changes direction to about 108° true (E mag.) to Cape Mendenhall, the southern point of the island. In the first 22 miles from the southwest cape, the few soundings taken show deep water fairly close to the shore, and following the coast at a distance of 2 miles is apparently safe. But at a distance of 5 miles or more offshore there is an extensive bank on which soundings of 4¾ to 6 fathoms have been made. The bank is included approximately between latitude 59° 46′ and 59° 53′ N, and longitude 166° 50′ and 167° 20′ W.

Cape Mendenhall, the southern point, is about 200 feet high, with a steep bluff on its east side, which extends halfway to the bottom of the bight between this cape and Cape Corwin. Breakers are said to exist 6 or 7 miles from Cape Mendenhall. In 1900 the *Manning* rounded the cape at a distance of about 5½ miles in depths of 13 to 14 fathoms.

Cape Corwin, the eastern point, is low, with a rocky shore north of it; the cape is definitely marked by the twin peaks of a mountain, which can be seen 25 miles in clear weather. The *Manning* passed about 2 miles eastward of the cape in depths of 10 to 11 fathoms.

The three following **anchorages** are from an oral description by Capt. J. L. Fisher, who anchored with a stern-wheel steamboat in each of them in July, 1898:

The first is in the bight between Cape Mendenhall and Cape Corwin, close inshore, in 3 fathoms, with sand and gravel bottom. Fresh water can be obtained at this anchorage.

The second is in the cove on the north side of Cape Corwin; it is very rocky and a poor anchorage. Fresh water can be obtained here; it is discolored and of poor quality.

The third is on the north side of, and about 12 miles eastward of, the north end of the island. It is in a cove open eastward, but deep

enough to afford shelter from northerly and southerly winds. Capt. Fisher considers this the best anchorage on the east side of the island. Fresh water can be obtained at this place. In 1900 the *Manning* cruised in this locality and reports that the anchorage on the north side of Cape Manning has not the appearance of a good harbor at low water, and that the rise and fall of tides is 12 feet.

From Cape Etolin the shore trends in a general 120° true (E by S mag.) direction about 20 miles to a point called **Cape Manning**, and from the latter cape to Cape Corwin the direction is 176° true (SSE mag.) and the distance about 16 miles. An island called **Triangle Island** lies about 6 miles westward from Cape Manning, and about 3 miles from the shore of Nunivak Island, with reported foul ground between. The *Manning* passed about 1 mile northward of the island in depths of 7 to 9 fathoms.

Cape Etolin, the northern point, is a narrow strip of land about ¾ mile long. There is a ridge of low hills about midway of this outer strip. A small island lies about 2 miles off the end of the cape, with ledges between it and the point of the cape. A dangerous rocky spit makes westward for probably more than 1½ miles from Cape Etolin.

On the southeast side of Cape Etolin there is an anchorage in **Etolin Bay,** which is a bight open northeast. This bay averages about ½ mile wide and nearly ¾ mile long. Near the southerly side and about ⅓ mile from the head of the bight an anchorage in 18 feet can be found; farther out it is deeper but more exposed to the effects of the strong tidal currents and rips of **Etolin Strait.** The holding ground is gravel and only moderately good. There is a small native winter village at the northwest corner of the bay.

In 1900 the *Manning* made a reconnaissance of Nunivak Island, and found a shoal (3 fathoms) about 10 miles 355° true (NNW mag.) from Cape Etolin, with deep water between. Keeping Cape Vancouver bearing northward of 86° true (ENE mag.), Cape Etolin can be rounded, when coming from westward, in 10 fathoms of water. With Cape Vancouver bearing 86° true (ENE mag.) or eastward of this bearing, considerable shoal water and irregular depths are found.

Nash Harbor, on the north side of the island, nearly halfway between Cape Etolin and Cape Mohican, is a good harbor except with winds from northwest through north to northeast. On the western point at the entrance are a number of Indian graves, and at the head of the harbor is a frame house, which can readily be distinguished at a distance of 3 miles.

Tides.—The mean rise and fall at Nunivak Island is 3 feet. There is nearly two hours difference in the time of tide on the north and south sides of the island.

It is stated that the tidal currents in Etolin Strait are so strong that the middle portion does not freeze over in winter.

ST. MATTHEW AND ADJOINING ISLANDS.

These are rocky, uninhabited islands, whose shores are little known and are poorly charted. During the season of navigation fogs are very prevalent in their vicinity and vessels should keep away from them. From what is known of them, anchorage may be made with

an offshore wind on nearly all sides, though the shore should be approached with great caution.

Pinnacle Island is a remarkable narrow rock, about 1 mile long, 200 yards wide, and 900 feet high, which rises so abruptly from the water that there is scarcely a place for a boat to land. There are numerous small rocks near the island, and it should be avoided. Lieut. S. P. Edmonds, R. C. S., reports that from observation and bearings on Cape Upright and Sugarloaf Peak, Pinnacle Island is about 2 miles westward of the position shown on the chart.

There are reports of uneven bottom, with depths of 6 to 9 fathoms or less, on what appears to be a ridge connecting Pinnacle Island with St. Matthew Island. Vessels are advised to avoid this passage.

ST. MATTHEW ISLAND.

Cape Upright, the eastern point of St. Matthew Island, is high and vertical, and the land in its immediate vicinity is mountainous; off the cape is a detached rock about 25 feet high. Westward of the high land of the cape there is a low neck, apparently of sand, and the cape might easily be mistaken for a detached island.

Glory of Russia Cape, the northwestern point of St. Matthew Island, is also high and mountainous, and the land between it and Cape Upright is a succession of hills and low valleys that extend across the island from north to south.

There are numerous detached rocks along all the shore of this island, which should not be approached too closely.

There is an abundance of fresh water on the island in streams and fresh-water lakes.

There is a good anchorage on the north side of the island in a bight 6½ miles westward of Cape Upright, with **Sugarloaf Mountain** bearing 218° true (SSW mag.), and westward of some outlying rocks which show well out of water and should not be approached closely. This anchorage is protected from southerly winds between southeast and southwest. Landing is difficult with any swell at all, as the beach is of stones and rather steep. With northerly winds anchorage can be had on the south side of the island.

Hall Island is high and rugged on its northeast, north, and west sides, and slopes to the southeast point, where it is low. There is a large detached rock off Cape Hall, and a number of detached rocks on the south side of the island. There is anchorage in 10 fathoms on the east side of the island in the bight where ruins are indicated on chart No. 8851.

Sarichef Strait is the passage between St. Matthew and Hall Islands. The tidal currents and rips are strong, and the rocks on either side give it a bad appearance. It is said to be clear in mid-channel.

Tides.—The mean rise and fall at St. Matthew Island is 2.4 feet. The flood current sets eastward, and the ebb westward, at the rate of 1 to 2½ miles.

CAPE VANCOUVER TO APOON PASS.

Cape Vancouver is a bold promontory, possibly 1,000 feet high. The shoal from the mouth of the Kuskokwim River is thought to extend along the coast to Cape Vancouver, so that on the south side of the cape the water is shoal. Immediately off the end of the cape

there is deep water, which extends about 5 miles along the north side to the bight on which the native village of **Tanunak** is situated. This bight is a series of mud flats, mostly bare at low water. The *Bear* anchored in 4½ fathoms about 1 mile off the south point of the bight. From observation on that vessel, shoals extend off the mouth of that bight northwestward, and **Hazen Bay** is supposed to be shallow.

Father Barnum states that there are shoals parallel with the coast, behind which small boats go when coasting between Scammon Bay and Nelson Island. He is uncertain as to their exact limits and location, but they are believed to extend from the north entrance to Hazen Bay to, or nearly to, Cape Romanzof, with passages through in places.

Cape Romanzof is a bold and prominent headland with cliffs rising abruptly from the water over 1,200 feet along its western face; at the sharp extremity of the cape there are remarkable perpendicular shafts of rock on the side of the cliff. The cape is the western termination of the **Askinuk Mountains**, the highest of which (2,363 feet) is about 5 miles from the cape and can be seen a considerable distance at sea. A tidal current of about 1.6 knots was observed off the point.

Northeastward of the cape, 4½ miles, is the southern end of the **Sand Islands.** These two islands extend in a general north and south direction about 13 miles, including the interval between them, and at a distance from the coast diminishing from 7 to 5 miles. The north island is mostly covered at high tide.

The coast trends in an easterly direction from Cape Romanzof 15 miles to the mouth of Kun River, and throughout most of this distance is bordered by abrupt cliffs and hills gradually diminishing in elevation.

Scammon Bay lies between this shore and the south Sand Island. In general it is very shoal, with numerous bars bare at low tide. There are two small coves along its south side, respectively 1 and 9 miles from Cape Romanzof, but both are quite shoal. There is a limited area with depth of 5 fathoms just south and east of the southern end of Sand Island, and there is a channel of the same depth leading into this and passing about 2¼ miles north of Cape Romanzof. A narrow channel with a minimum depth of about 2 fathoms continues through Scammon Bay and into the **Kun River.** There is 2 to 4 fathoms off Cape Romanzof but the water shoals quickly northeastward, so there is little protection except for very light-draft boats. There is a large shoal area with breakers about halfway between the cape and Sand Island, and another shoal with less than 2 fathoms lies 2½ miles 338° true (NW ⅜ N mag.) from the cape. Along the high land forming the south shore of Scammon Bay the water is 1 fathom or less in depth throughout its length, excepting just inside Cape Romanzof. The mean rise and fall of tides at the entrance to Scammon Bay is 5.2 feet.

North from the mouth of the Kun River the coast is low and marshy to the Yukon River mouths. It is reported to be extremely shoal between the northern Sand Island and this shore.

The **bay south of Cape Romanzof** has not been explored, but a number of bars, bare at low tide, were seen extending across its entrance between the cape and the north end of an island; near the latter there appeared to be a channel. The coast between Cape Romanzof and Nelson Island is low, and it is reported that the adjacent waters are shoal.

The **Yukon Delta** extends from the Black River to Apoon Pass, a distance of about 90 miles. The land along the coast is only a foot or two above high water, is covered with low marsh grass, and is entirely lost to view when but a few miles offshore. The only landmarks visible in clear weather are the sharp peaks of **Kusilvak Mountain** and the **Askinuk Mountains** back of Cape Romanzof, all very distant and often obscured by clouds or mist. The extreme flatness of the land and the remarkable mirage effect, often seen over the shoals when bare, make the whole region deceptive at times.

The river discharges by many mouths through the delta. The bars at the entrance have little depth, and the channels through the flats are narrow, crooked, and bordered by shoals bare at low water. They are also subject to constant change. **Apoon Pass** (see p. 273) is the entrance used by the river steamers.

When well inside the confined banks, the country on each side is covered with an almost continuous growth of willow and alder bushes. The water has a brownish-white appearance, something like glacial water, without its fine, sharp grit. It has no unpleasant taste, and is always fresh in the inner channels.

The main channels are everywhere free from snags, though trees are sometimes seen temporarily lodged on the bars, and quantities of driftwood are piled along the shores in places. Undoubtedly the ice freezes in and carries off the snags when it goes out each season. The channels and banks show indications of changing rapidly both from erosion and deposits. Very probably much of this is effected each year during the breaking up of the ice, its consequent jams, and the great floods following.

Inhabitants.—No white men live in the delta south of the Apoon except the Catholic missionaries at a summer fishing station. The native summer settlements near the mouths are shown on chart 9370. The natives are friendly and honest, and will attempt to pilot boats, with more or less success.

Currents.—None were observed to exceed 3 miles per hour. In the delta channels currents were observed varying from 0.5 to 1.6 miles. The velocities were greater in the bar channels and up the river.

Weather.—The prevailing winds in summer are northeasterly, easterly, and southeasterly; the strong blows are believed to come from the same directions. Fogs were unusual, but there was a good deal of thick mist and rain.

Yukon Flats.—The 6-fathom curve is about 10 miles westward of Cape Romanzof. From about 15 miles off Cape Romanzof the 6-fathom curve on the western edge of the flats has a general 24° true (N ⅜ E mag.) direction for about 108 miles to latitude 63° 32′ N, longitude 164° 58′ W. At this point it turns to a general 87° true (NE by E ⅞ E mag.) direction for 61 miles to the west point of Stuart Island. On the western edge of the flats the 3-fathom curve is 1½ to about 5 miles inside the 6-fathom curve, while on the northern edge the distance between the curves ranges from 5 to 10 miles. For a distance of 40 miles northward of Cape Romanzof detached shoals with 3¾ to 6 fathoms over them lie as much as 10 miles westward of the flats as described above, and deep-draft vessels should give the cape a berth of 30 miles to avoid these shoals. When in the vicinity of the flats vessels should not shoal the water to less than 8 fathoms.

ST. LAWRENCE ISLAND.

The eastern end of this island is usually made by vessels bound into Norton Sound, and in clear weather can be seen from a distance of 30 to 35 miles. From Southeast Cape a ridge of mountains extends in a northerly direction across the island, and another ridge extends in a northerly direction from East Cape to Northeast Cape. Between these two ridges a deep bight makes in from southward and at its head very low land extends northward across the island. The shore of the eastern end of the island is generally a low sand beach with outlying rocks; the mountain ridges begin ½ to 2 miles back from the beach.

Northeast Cape is low tundra land, with numerous fresh-water lakes, 2 miles wide to the foot of a mountain which rises abruptly and has a peak 1,435 feet high which can be seen on a clear day a distance of 35 miles or more. At ¼ and ⅝ mile from the end of the cape are two hummocks 94 and 280 feet high, respectively; the lower hummock is in latitude 63° 17′ 45″ N, longitude 168° 41′ 40″ W, as determined by the Coast and Geodetic Survey in 1902.

Although the bottom is irregular off the point of the cape, no break was noticed while passing it in rough weather. The north shore of St. Lawrence Island, for a distance of 10 miles westward of Northeast Cape, is a low sand beach and grassy tundra with numerous fresh-water lakes. Anchorage with shelter from southerly or southeasterly winds can be had along this shore about 2 miles from the beach in 8 to 9 fathoms of water; the holding ground is not good, the bottom being gravel. At a point on the north shore 6 miles westward of Northeast Cape, breakers extend 1 mile offshore.

From Northeast Cape the east coast of St. Lawrence Island has a general 192° true (S ½ E mag.) direction for 4 miles to a point where a spur, 450 feet high, from the higher hills reaches to within ½ mile of the beach. In this stretch the 6-fathom curve is ¾ to 1 mile offshore. A current observation made 2 miles southward of Northeast Cape and 1 mile offshore gave a maximum velocity of 1.4 miles on both flood and ebb; the flood sets northward and ebb southward alongshore.

The east coast of the island then trends 209° true (S by W mag.) for 4 miles, and then curves westward and northward in a distance of 5 miles until it has a 322° true (NW by W mag.) direction, forming **East Cape.** The coast of this entire section is a low, narrow strip with a large lagoon back of it. East Cape is so rounding that there is no particular point to which the name applies. The mountains are about 2 miles back of it and are about 900 feet high.

Punuk Islands, lying 4 to 5 miles 164° true (SE by S mag.) from East Cape, is a group of three small islands 1½ miles long; the northeastern end of the group lies about 13¼ miles 192° true (S ½ E mag.) from Northeast Cape. The northernmost and largest island has two marked rocky hummocks, the higher having an elevation of 100 to 150 feet; on the southwestern end of the island are the remains of a native village. The southernmost island is an irregular mass of rocks, the highest point about 75 feet above water. Between these islands is a low, sandy islet, which is separated from the other two by narrow channels completely obstructed by ledges over which the sea breaks. The shores of all the islands are foul, and a ledge extends

southward from the southernmost island; the *Patterson* passed 2 miles southward of the islands in a least depth of 8 fathoms. Vessels should approach these islands with caution.

A heavy break was observed in the channel between Punuk Islands and East Cape, and vessels should not attempt to pass through. From eastward the islands can be approached as close as 2 miles.

A current observation made 2¾ miles 220° true (SSW mag.) from Punuk Islands showed the flood currents setting about 24° true (N ½ E mag.) with a maximum velocity of 1.1 miles.

Southeast Cape is about 5 miles across on its southern face; the eastern point of the cape slopes gradually to the water for a distance of ¼ mile from the high land, and a reef extends about ½ mile southeast from the point. The western point is lower and slopes more gradually to the water for a distance of 3 miles from the high land, and a reef makes off from the point in a southerly direction for a distance of 2 to 3 miles. The bight between these points is very foul and should be avoided.

Cape Kialegak, about 5 miles northward of Southeast Cape, is a long sand spit strewn with rocks, extending in a northeasterly direction from the high land of the coast, and forms what is in appearance a good anchorage in southerly winds. There are breakers about ¾ mile 355° true (NNW mag.) from the end of the cape, and there may be others inside; a reef extends southward from the south side of the sand spit for a distance of about 1 mile. The remains of a native village on the sand spit serve to identify the locality.

The deep bight westward of East Cape is little known; vessels have anchored well up toward the head of this bight. Vessels entering should give the points a good berth and exercise caution.

Cape Chibukak, probably 600 feet high, is a steep, black bluff, flat on top. There is a wide sand beach west of the bluff, on which is a native village called **Gambell**. This native village, and the one on Southwest Cape, are the only inhabited parts of the island.

The water is deep close to Cape Chibukak, and anchorage may be made on either side of the point of the sand beach off the native village, ½ mile from shore, in about 7 fathoms, hard bottom.

The western end of the island, south of Cape Chibukak, is rolling land. From West Cape around to the bay east of Southwest Cape the land is mountainous, and abrupt close to the coast, being highest at **Southwest Cape**. Between the high land east of Southwest Cape and Cape Chitnak the land is low. A reef makes off 1 mile in a 220° true (SSW mag.) direction from **Cape Chitnak** and is bare at low water. The submerged part of this reef extends about 2 miles in a general 175° true (SSE mag.) direction from the bare part. This reef is dangerous, as the water shoals abruptly when approaching the cape. The rest of the island is generally high and rolling. There are some sunken rocks in the bight westward of Southeast Cape, and also some detached rocks showing off the north shore near **Cape Kukuliak** and **North Cape**. It is probable that with care an anchorage may be found almost anywhere around the island, but the shores must be approached with caution.

Tides.—The mean rise and fall at St. Lawrence Island is probably about 1 foot at the east end, increasing to perhaps 2 feet at the west end. The time of high water probably changes rapidly from point to point, but no tidal observations have yet been made.

NORTON SOUND.

Norton Sound is at present the most important arm of Bering Sea. Some supplies for the Yukon River by way of St. Michael pass through it. The north shore is also important because of the mining operations now conducted there. The south side of the entrance to the sound is occupied by the extensive Yukon Flats, and should be avoided by deep-draft vessels. The rest of the sound generally has soundings of 8 to 12 fathoms, the greater depths being near the north side. Off Cape Nome and Cape Darby there are spots with depths of 15 to 19 fathoms. The bottom of the sound is very even, the depths decreasing to the shore with marked regularity, and the lead will indicate the approach to dangers, and should be kept going constantly. There is driftwood on all the shores of the sound.

Fog.—The remarks on fog, page 228, apply also to the region west of Cape Nome, but not to Norton Sound east of it. On entering the sound with thick weather in Bering Sea, the fog will almost always thin out and gradually clear as the vessel proceeds up the sound. At St. Michael fogs are rare.

Mirage.—In the vicinity of St. Michael and Stuart Islands and the coast southward mirage often distorts the appearance of the land, small objects being sometimes greatly magnified.

Stuart Island lies northwest of St. Michael Island, from which it is separated by **Stephens Pass**, about ⅔ mile wide in its narrowest part. **Stuart Mountain**, 483 feet high, east of the center, is the highest point. The rest of the island is low and rolling, with some small, scattered peaks. The shore of the island is very irregular. From North Point to Observation Point and around through Stephens Pass is a line of conspicuous bluffs about 170 feet high; the rest of the coast is much lower. From Observation Point to the west point of the island the north shore is free from outlying dangers; 5 fathoms can be carried 1 mile from the beach. Off the west point, some detached rocks extend about 300 yards. On the east face of the island well toward the southeast point a shoal makes out about 3 miles.

St. Michael Island is separated from the mainland by a narrow, crooked, tidal slough, called **St. Michael Canal.** The island is generally low, and has two conspicuous elevations: **St. Michael Hill**, near the center, 472 feet high; and **Stephens Hill**, a sharp, conical hill overlooking Stephens Pass. There is a light on **Cape Stephens**, the western point of St. Michael Island. A reef extends 1½ miles off **Rock Point**, the point 51° true (NNE ⅝ E mag.) from St. Michael Hill, and is marked on its northeast edge by a buoy in 29 feet of water.

Whale Island, lying close off the east end of St. Michael Island, is about ½ mile long east and west, 118 feet high, and on approaching the harbor its east end is seen as a vertical bluff. It is marked on its eastern end by a light. The passage between this and St. Michael Island is blocked by rocks, bare at low water. Eastward and northward of the island the water deepens rapidly.

Beulah Island, about ¼ mile northwest from Whale Island, is about 50 feet high, small and rounded. It has bold water off its northeast side. Between this and Whale Island the water is shoal.

The **tidal currents** in Norton Sound are small, seldom exceeding 0.2 knot at strength.

ST. MICHAEL.

St. Michael, on the east point of St. Michael Island, is the point of transfer from deep-water vessels to the Yukon River steamboats of the trading and transportation companies doing business on the Yukon and its tributaries. This trade during the open season of about four months is extensive. Some of the companies have small wharves for the light-draft river vessels, and extensive warehouses on St. Michael Island and opposite on the mainland. Seagoing vessels discharge their cargoes by lighters. There is a wireless telegraph station, and communication by telegraph with the interior of Alaska and Seattle.

Supplies.—Coal can generally be had for steamers; water and general supplies can be had at St. Michael.

Repairs.—The facilities for repairs above water and to woodwork are good. Several blacksmith shops and small machine shops can handle ironwork and minor repairs to machinery.

Anchorage.—There is no harbor for seagoing vessels; the anchorage is an open roadstead exposed to winds from northwest through north to east. The larger vessels anchor in the offing between St. Michael Bay and Egg Island, and in heavy northerly gales shift their anchorage to get a lee under Egg Island or go to sea. Anchorage is found about ½ mile southeastward of Whale Island in 3½ to 4 fathoms, bottom dark-blue mud and good holding ground.

Light-draft vessels and river steamers can find shelter from northerly and westerly winds by anchoring close in under the east side of the island, in 3 to 8 feet. The shores of St. Michael Bay are strewn with loose rocks, which are often frozen in the ice in winter and dropped as it goes out in the spring. Light-draft vessels, when anchoring in shoal water, should be careful not to anchor over any of these loose, scattered rocks.

Egg Island.—This island has been used as a quarantine station. Vessels detained at quarantine anchored off the eastern shore, where good water is found. The water off the western shore is deeper, 6 fathoms being found close inshore. The island is so small that it does not afford much protection in heavy weather, but it is the only lee to be had in northerly gales.

Tides.—See Coast and Geodetic Survey tide tables, in which the tides are predicted for every day of the current year during the season of navigation.

Ice.—The records of the Alaska Commercial Co. from 1880 to 1899, both inclusive, show that ice begins to move out of St. Michael Bay between May 31 and June 25, the former being the earliest date recorded and the latter the latest. The earliest date recorded for ice forming in St. Michael Bay is October 6 and the latest November 10; during the past 10 years, however, the dates when ice formed ranged from October 18 to November 10. (See also p. 226.)

ST. MICHAEL BAY TO CAPE DARBY.

The coast is generally low and rock strewn, and the depths when approaching it shoal gradually from 6 fathoms toward the beach; a depth of 3 fathoms can be taken as close as ¾ mile except in a few places. There are no outlying dangers, but a reef makes off about

½ mile from the shore 2 miles southward of **Black Point**, the point about 26 miles northeastward from St. Michael. **Tolstoi Point** and its vicinity are high and rocky, and from there to Unalaklik River the shore is low. A shoal extends about 1½ miles off the mouth of the **Unalaklik River**; there is no channel through this shoal into the river except for light-draft craft. Good anchorage, in southerly winds, is found in the bight eastward of **Kiktaguk**, about 15 miles eastward of St. Michael. There are a number of native villages on this coast, and a depot for supplies at **Unalaklik**.

Besboro Island is 600 feet high and very prominent; on a clear day it can be seen from St. Michael; it affords a poor lee, as the wind draws all around the island. A shoal with depths of 4 to 4¾ fathoms makes off 2 miles in a northeasterly direction from the north end of the island; the western side of the island is bold-to, and the eastern side of the island can be approached as close as ½ mile, with a depth of over 5 fathoms.

Cape Denbigh is a moderately high, rounded hill, joined to the mainland by a low, narrow neck. The head of the bight, eastward of the cape, is shoal, but in approaching the water shoals gradually. A good anchorage in northeasterly winds can be had eastward of the cape in depths suitable to the draft of the vessel. The south end of the cape is bold-to, and its western side, 2½ miles northward of the point, can be approached close-to in 4 fathoms of water. The water shoals rapidly inside a depth of 4 fathoms when approaching the shore.

Norton Bay is generally shoal. About midway between **Point Dexter** and **Bald Head** there is a depth of about 6 fathoms, and from this depth the water shoals gradually, as the shores are approached in any direction inside of Bald Head. In some places the 6-foot curve is 5 miles or more from the beach. The north shore of the bay for a distance of 15 miles westward of Bald Head is comparatively low, and the water is shoal for some distance from the shore. From a point 15 miles west of Bald Head to Cape Darby the land is high and wooded along the coast; a few native villages are located on this stretch. For a distance of 20 miles northeastward from Cape Darby a depth of 4 fathoms can be taken ⅓ mile from the shore, and in some places much closer. The water shoals gradually on approaching the coast, but the south and east sides of Cape Darby have deep water close-to. During strong northerly winds the water is lowered considerably in Norton Bay.

Cape Darby is a high, rounded mountain, which terminates at the water in steep, rocky bluffs. **Rocky Point** is a high, bold promontory with irregular rocky cliffs.

GOLOFNIN BAY,

the entrance to which lies between Cape Darby and Rocky Point, with a width of 10 miles, extends in a general northerly direction for 12 miles to the entrance to Golofnin Sound. The east shore is high and bold, with occasional sand and gravel beaches. **Carolyn Island**, low and rocky, lies ¼ mile off the east shore, about 8 miles north of Cape Darby. The west shore for about 3 miles north of Rocky Point is high and bold, but beyond this is a low sand beach, with a prominent point about 5 miles north of Rocky Point. At the head of the

bay on the west side the entrance to Golofnin Sound lies between a sand spit projecting from the eastern shore and a low sand island extending northward from the west shore and connected with it at low water.

Deep water can be carried close under Cape Darby and Rocky Point. Eastward of Rocky Point is an extensive middle ground on which the least depth found was 3¾ fathoms; on its east edge it rises abruptly from 6 and 7 fathoms. With the exception of this middle ground the bay is free from dangers south of the low point on the west shore, the deepest water being on the east side, and ranging from 11 fathoms close under Cape Darby to 4 fathoms ½ mile northwest of Carolyn Island. In the south part of the bay the high land may be approached closely, but off the low land the 3-fathom curve is in places nearly 1 mile offshore.

Anchorage.—A little westward of the southern sand spit, in the entrance to Golofnin Sound, anchorage may be had in 6 to 7 fathoms, with protection from all winds. For vessels whose draft prevents the use of this anchorage, the best is off the point on the west side of the bay in about 4 fathoms. This is unsafe in southerly weather, but is the most convenient for communicating with the head of the bay. By shifting anchorage from one side to the other in Golofnin Bay, good shelter is found from easterly or southwest or westerly winds.

Golofnin Sound.—In the north part of the bay an extensive shoal, with 4 to 8 feet, makes out in a northeast direction from the west shore to within ¾ mile of the east shore, its extremity lying about 2 miles 93° true (ENE ⅜ E mag.) from the north point of the low sand island on the south side of the entrance to Golofnin Sound. The channel leading to the entrance to Golofnin Sound lies on the eastern side of the bay, passing around the east end of the shoal and following the eastern shore at a distance of ⅜ to ¾ mile, with an average width of 800 yards. The least depth in the channel is 13 feet at low water, but 15 feet has been taken in at high water. The rise and fall of the tide (diurnal) is about 3 feet, but this is influenced by the prevailing winds, which have a tendency to bank up the water in heavy southerly weather, and to lower it with northerly and northeasterly winds.

Golofnin (Golovin post office), on the north spit at the entrance to Golofnin Sound, is a distributing point for the mining district of the Fish River country.

Golofnin Sound is very shallow and is navigable for small steamers of 3½ feet draft which ply from Golofnin to the mouth of the **Fish River**, which empties into the head of the sound. The channel through the sound is narrow and tortuous.

ROCKY POINT TO CAPE NOME.

For about 22 miles, from Rocky Point to Topkok Head, the land is high and bold, in many places rising abruptly. Beyond this to Cape Nome the coast is low with high land farther back. Immediately behind this low land is a large shoal lagoon with two small entrances, the west one called Port Safety. Between Rocky Point and Cape Nome the water is deep, the bottom regular, and by giving the shore a berth of 1 mile, a depth of 6 fathoms or more will be found.

Topkok Head is 22 miles westward of Rocky Point, and is the first high land close to the coast eastward of Cape Nome. Its seaward face rises abruptly from the water 586 feet and is a well-known and conspicuous landmark.

A yellow bluff, 572 feet high, on the east side of **Bluff post office**, about 6 miles eastward of Topkok Head, is conspicuous, but not as much so as Topkok Head.

Solomon is a post office at the mouth of **Solomon River**, 11 miles westward of Topkok Head and 17 miles eastward of Cape Nome. A railroad is under construction up Solomon River. From a survey made in 1902 there was a depth of 3 feet on the bar at the entrance and inside Solomon River, but local knowledge is necessary to keep in the best water.

Port Safety is a small anchorage for vessels of less than 7 feet draft; it is about 8 miles eastward of Cape Nome. The channel is narrow and has a depth of 7 feet. Small vessels can anchor in the narrow sloughs which lead between the flats inside the entrance.

DIRECTIONS, UNIMAK PASS OR CAPE KALEKTA TO NORTON SOUND OR PORT CLARENCE.

For vessels of any draft.—If no observations can be obtained on account of thick weather, the lead must be depended upon and used constantly, as the currents are liable to set a vessel off her course.

To avoid Nunivak Island, and also to sight the island in clear weather so as to check the vessel's position, the course should be laid to pass about 18 miles westward of the island in latitude 60° 14′ N and longitude 168° 04′ W.

I. **From a position 5 miles 254° true (SW by W mag.) from Cape Sarichef lighthouse**, on the eastern side at the northern end of Unimak Pass, a 344° true (NW by N mag.) course made good for 353 miles should lead to the above latitude and longitude, and Cape Mohican should bear about 95° true (ENE ⅞ E mag.) and be distant 18 miles.

II. **Or, from a position 3 miles westward from Cape Kalekta** a 352° true (NNW ¼ W mag.) course made good for 376 miles should lead to the above position with Cape Mohican bearing 95° true (ENE ⅞ E mag.), distant 18 miles.

On the above courses little can be said of the currents except that with a strong wind from any direction a current is likely to set with it. A slight northerly set will sometimes be experienced. Thick weather is the rule in Bering Sea during the season of navigation, and care should be observed when in the vicinity of Nunivak Island (see also the description of Nunivak Island, page 257).

III. **From Cape Mohican** bearing 95° true (ENE ⅞ E mag.), distant 18 miles, a 4° true (N by W ¼ W mag.) course made good for 166½ miles will lead to a position in latitude 63° N and longitude 167° 40′ W; the highest peak (1,462 feet) 3 miles back of Northeast Cape, St. Lawrence Island, should then bear 300° true (W by N mag.), distant 35 miles, and will be visible in clear weather at this distance. From this position:

IV. **If bound to St. Michael.**—Make good a 53° true (NE by N mag.) course for 76½ miles to a position in latitude 63° 46′ N and longitude 165° 24′ W. On this course the depth should be 12 fath-

oms or more until the vessel has arrived at the above position. From the above latitude and longitude a 93° true (ENE ½ E mag.) course made good for 81 miles will lead to a position 3 miles northward of Stuart Island with Stuart Mountain bearing 201° true (S mag.). From this position make good a 126° true (ESE ¾ E mag.) course for 14½ miles, giving the shore of St. Michael Island a berth of 3 miles. Whale Island light should then bear on the starboard beam distant 3½ miles, and deep draft vessels can anchor in this position in about 5¾ fathoms. (See also "Anchorage," page 266.)

On the 93° true (ENE ½ E mag.) course the lead should be frequently used, and if the water is shoaled to less than 8 fathoms while westward of Stuart Island it is pretty safe to assume that the vessel is southward of her course. Thick weather is not as prevalent in Norton Sound as in Bering Sea, and it is but seldom that Stuart Island and the mountains southeastward of St. Michael can not be seen and used as landmarks.

V. **If bound to Golofnin Bay.**—Follow the directions in section IV, and when the vessel is in latitude 63° 46′ N and longitude 165° 24′ W make good a 59° true (NE ⅝ N mag.) course for 71 miles, which should lead to a position about 2 miles southeastward of Rocky Point (the high point on the western side of the entrance to the bay).

VI. **If bound to Nome.**—From a position in latitude 63° N and longitude 167° 40′ W make good a 33° true (N by E ¼ E mag.) course for 100 miles, which should lead to a position about 8 miles from the beach abreast the town. Anchor according to draft, as indicated in the description of Nome on page 274.

VII. **If bound to Port Clarence.**—From a position in latitude 63° N and longitude 167° 40′ W a 0° true (N by W ⅝ W mag.) course made good for 138 miles will lead to a position about 8 miles from Cape York. Then follow the directions under heading "Port Clarence."

On the 0° true (N by W ⅝ W mag.) course, King Island should be left about 8 miles on the port hand when the vessel has been standing 119 miles on this course. A northerly or northwesterly set of the current may be found after the vessel has stood about 90 miles on the course. In clear weather the mountains back of Cape York should be sighted after King Island has been passed and the cape should be made on the starboard bow. The depths until abreast King Island range from 15 to 20 fathoms; but northward of King Island the soundings are irregular and care should be taken not to be set eastward toward the shoals which lie off the coast between Cape Douglas and Point Spencer (see p. 275).

DIRECTIONS, ISANOTSKI STRAIT TO ST. MICHAEL.

The following remarks are intended to apply only to **small craft and river steamboats.**

After passing out of Isanotski Strait, clear of the outlying breakers, the course is shaped for the east side of Amak Island. Shelter can be found on the south, southeast, and east sides of the island. Some of the Moran fleet found shelter in 1898 on the east side in about 6 fathoms. Capt. J. L. Fisher states that he crossed pretty close inshore over the indicated shoal off the southeast end, with a least

depth of 7 fathoms. He also states that the outlying rocks and reefs off the north end of the island appeared very nasty and dangerous.

Leaving Amak Island, the next course is laid for Cape Newenham. Shelter can be obtained on either side, according to the wind.

From Cape Newenham the course is laid for Nunivak Island. If heavy northerly or northeasterly winds are encountered before the island is reached, shelter is sought in the depth of the bight on the south side. Weather conditions being good, it is only necessary to touch at this island if needing water. The anchorage on the north side, about 12 miles eastward of Cape Etolin, is considered the best. (See Nunivak Island, p. 257.)

From the northern end of Nunivak Island the customary course is to cross over diagonally to a little north of Hazen Bay, and then coast along just outside the shoals, in 3 to 5 fathoms of water, until Cape Romanzof is reached. If the weather is unpropitious or water is required, an anchorage in Scammon Bay is made close inshore on the south side, in a bight where a stream empties.

After leaving Scammon Bay, by giving the spit on the north side of the entrance a good berth, the remaining distance to St. Michael is made by skirting along on the outer portion of the Yukon Flats, in 2 to 5 fathoms, where the courses are exclusively guided by the use of the lead. On this crooked stretch, after the mountains of Cape Romanzof and the Kusilvak Mountains disappear, no land will be visible until the high peaks on the mainland south from Stuart Island are sighted; a little later the summits of Stuart and St. Michael Islands become visible. After Stuart and St. Michael Islands become defined, the course is shaped to go through the pass between them, and then skirt around the north side of St. Michael Island to St. Michael.

In the summer, from all that can be learned, northerly and easterly winds prevail a large portion of the time between Cape Newenham and Cape Romanzof.

The **tidal currents** in Etolin Strait are strong and at times cause heavy tide rips.

COAST FROM ST. MICHAEL TO APOON PASS.

St. Michael being the end of deep-water navigation, all the Yukon traffic beyond this point has to be conducted with vessels drawing 5 feet or less. The larger river steamboats leaving St. Michael Bay go around the north side of St. Michael Island and through Stephens Pass, between St. Michael and Stuart Islands. They give the reef off **Rock Point**, on the north side of St. Michael Island, a wide berth, and after passing between the islands a straight course is made slightly westward of Point Romanof. When the summit of Point Romanof is abeam, distant about 1½ miles, the direction is changed and a course is made for the range lights for entering the Apoon Pass. The most dangerous portion of the passage is the 14 miles around the north end of St. Michael Island, which is exposed to the deep-water swell from the north. This can be avoided by small craft by going through St. Michael Canal.

St. Michael Canal separates St. Michael Island from the mainland, and is a narrow, crooked, tidal slough, which forks and comes together again. The distance through by way of the north fork is 18 miles

and by the south one 20 miles. The southern and longer one is the wider, and for that reason is the one generally used. There is a sufficient depth in the canal for ordinary river steamboats. The northern entrance has a dredged cut 6¼ miles long and 100 feet wide, with a depth of 6 feet at low water, extending from deep water in St. Michael Bay. The channel, during the summer months, is marked by buoys.

The southern entrance has about 3 feet on its bar at mean low tide. Thus far, on account of its narrowness and sharp curves, it has only been used by the smaller class of steamboats. A light is maintained on **Canal Point** during the summer months.

From Stephens Pass to Apoon Pass is 42 miles along an open coast, but owing to the protection from heavy seas offered by the flats that extend seaward, it is safe in summer months for the flat-bottomed river steamboats that have to traverse it.

With the exception of the promontory of Point Romanof, the immediate coast is low and flat all the way from St. Michael Island to and including the Apoon entrance. The promontory of **Point Romanof**, 340 feet high, stands well out about 12 miles westward from the high hills of the coast range. After clearing Stephens Pass it appears in clear weather like an island in the sea. A light is shown on the point from about July 15 to October 15 of each year.

Coming north from the Apoon entrance after passing Point Romanof, Crater, St. Michael, and Stuart Mountains appear above the horizon, and afford excellent marks.

In moderate weather the ocean swell is not felt between Stephens Pass and the Apoon entrance; but in heavy weather and westerly weather, which is more likely to occur during the latter part of the season, there is a choppy sea which is heavier off Point Romanof than elsewhere. In general, after rounding the north side of St. Michael Island, this passage is safe for river steamers in the summer season. During the latter part of the season, however, high winds become more frequent, and the boats are obliged to watch their opportunities.

Anchorages.—River steamboats anchor on the flats or in the channel, wherever exigency demands.

Good shelter can be had in all but southwesterly weather in the cove on the south side of Cape Stephens, in 6 to 9 feet of water. Stebbins, a large Eskimo settlement, is located on this cove.

In the southern end of **St. Michael Canal**, in the southern branch, just above the junction, there is a good and safe anchorage in all kinds of weather. There is only about 3 feet at mean low tide on the outside bar, and it has to be crossed at high tide.

About 10 miles southward of Canal Point is the **Pikmiktalik River.** In the mouth of the right-hand stream there is anchorage for medium-sized steamers. The bar to this stream has only about 2½ feet on it at mean low tide. A shoal extends out from the south point at the entrance.

The mouth of the **Pastoliak River**, about 2 miles from the outer end of the Apoon Pass, affords anchorage for steamboats under medium size. The Apoon flats extend in front of the entrance, and it can only be entered at high tide.

APOON PASS.

This is the most northern outlet of the Yukon River, and is about 55 miles, via Stephens Pass, from St. Michael. It is used exclusively by the steamboats trading up the Yukon and its tributaries.

Apoon Pass is the extreme northeastern limit of the Yukon Delta. In common with the rest of this region, the country is low and flat, it being 1 to 2 feet above high-water mark. Down to within about 2 miles of its mouth, the banks are generally covered with low willow and alder bushes 8 to 10 feet high. Near the mouth the land becomes more marshy, and a considerable area westward appears to be entirely an open marsh. The open country eastward is flat, and is made up of marsh, ponds, and tundra. The only high ground in the general vicinity is **Hogback**, a rounded ridge about 300 feet high lying 5 miles east from the entrance. Some distance back from the coast, 12 to 18 miles, is seen the range of hills or mountains trending southwestward, which extend in that direction to where the Yukon makes its great bend to get around the end of this ridge. On these low, flat shores there are often remarkable mirage effects, tending greatly to magnify insignificant objects.

Bar.—Off the mouth of Apoon Pass, and for some distance northwestward, the bottom is nearly flat, having a depth of about 2 feet of water at low tide, and with little choice as to a channel. All but very light-draft vessels must time their departure from St. Michael so as to cross these flats at high tide, or must wait for the tide. Some dredging has been done on a project to cut a 6-foot channel across the flats at the entrance; the progress to date is shown on the current editions of the charts.

Pastol Bay front and rear range **lights** show the best lead across the flats. Pastolik River light, Apoon Bar light, and Apoon Mouth light are guides to the channel inside the flats. This channel is further marked by about 15 buoys, so that no detailed directions are necessary for following it. Lights and buoys are maintained only during the navigation season, from about July 15 to October 15 each year.

The distance between the Apoon mouth and the head of the delta is traversed by going up the Apoon Pass about 31 miles to where it branches off from the Kwikpak Pass, and then up the Kwikpak about 30 miles to the head of the delta, where it and the Kwikluak Pass separate the Yukon into two principal mouths. The channels and banks are subject to rapid change both from erosion and deposit.

Inhabitants.—The natives are mostly migratory, living at different places at different seasons. Their principal settlement, after leaving St. Michael Island, is on the **Pastolik River.** **Kotlik**, about 6 miles from the Apoon mouth, on the **Kotlik River**, has a store, Greek church, and a few dwellings. **New Fort Hamilton** is on the **Kwikpak**, 36 miles above Kotlik, where there is a station of the North American Trading & Transportation Co.

Pilots.—River steamboats in general carry Eskimo pilots, who may be hired at St. Michael and at various places on the river. They are, as a rule, familiar only with a portion of the river, those from St. Michael usually going up as far as Andreafski. A number of native pilots live at the village near the mouth of the Pastolik River. Except with local knowledge a pilot is necessary in following the Apoon. The

Eskimos are generally quick-witted and have a good eye for the water; but some who offer their services as pilots have little idea of the requirements of a steamer, being used only to their own skin boats.

Tides.—The tropic rise and fall in Apoon Pass is 4.8 feet. The tides at this entrance, as is the case with the shores of eastern Norton Sound, are greatly affected by the winds, northerly and easterly ones making low waters, and southerly and southwesterly ones making high waters. The wind effect may be sufficient to entirely obliterate the natural tide conditions. The effect of the tides reach above the head of the delta. At the head of the Kwikpak Pass the rise and fall is about 6 inches.

Current.—The ordinary outflow of the Apoon is much less rapid than other mouths of the Yukon; but there is a tidal inflow and outflow, the velocity of which depends upon the amount of the rise and fall of the tide at any particular time.

Ice.—In the fall thin ice begins to make in the river the latter part of September, and navigation in October is attended with danger of being frozen in. It is more than probable that the movement and clogging of the ice in the breaking up of the river in spring has much to do with the location and peculiarities of the channels and with clearing it perfectly from snags.

Supplies.—Immediately within the Apoon mouth the water is fresh, and that on the flats outside, close in, is nearly so, the degree of freshness depending upon the stage of the tide.

Cordwood is cut and sold by the natives along the river from the mouth up. Small woodpiles can be seen at intervals. That in the delta, and more particularly near the mouth, is of inferior quality, being cut from wet driftwood.

COAST FROM CAPE NOME TO BERING STRAIT.

Cape Nome is a bluff, about 300 feet high, apparently 1 mile broad, and rounded down to the water on either side, where there is low land at the shore, with higher land farther back. The water off this cape is quite deep. The tropic rise and fall of tides at Cape Nome is 2.1 feet.

From Cape Nome to Cape Rodney the coast, except abreast of Sledge Island, is a comparatively straight stretch of low sand beach with no projecting points and the higher land some distance back. Abreast of Sledge Island for a distance of several miles the hills slope down to the beach, giving this part of the coast the appearance of a point. The stretch of beach is broken by a number of small rivers, where mining is in progress. The entrances to **Nome, Snake, Penny, and Sinuk Rivers** have shifting bars, but there is generally water enough in the channels over these bars to permit steamers of 4 feet draft to enter. When approaching the coast between Cape Nome and Sledge Island, the water shoals regularly and gradually until a depth of 5 fathoms is reached; inside this depth the bottom is irregular, especially near the mouths of the rivers.

A small shoal, with about 18 feet over it, lies about 9 miles westward of Cape Nome and 2¼ miles offshore. Shoals extend a comparatively short distance off the mouth of Nome River.

Nome is on the beach at the mouth of the Snake River, about 11 miles westward of Cape Nome. The general anchorage for deep-

draft vessels is in 7 fathoms about 1 mile from the beach abreast the town. Vessels of less draft anchor in 5 fathoms a little closer to the beach, but it is not advisable to anchor in less. In strong southerly winds no landing can be made on the beach, and the anchorage is unsafe. Southerly winds raise the water and northerly winds lower it. At Nome there is a relief station of the United States Public Health Service, for the treatment of seamen, and a wireless telegraph station. There is a railroad up the Nome River to **Lanes Landing** on the **Kuzitrin River**, the latter emptying at the head of **Imuruk Basin**.

Sledge Island, about 31 miles west of Cape Nome and 4½ miles offshore, is a rocky, flat-topped island rising 604 feet above the water, and comparatively rounded in outline. There is a native village on a small, rocky slope on the east side; excepting this and a short sand spit making off from the northern end of the island, the shores are steep. The island may be safely approached from any direction, and anchorage may be had on all sides of it; the bottom is rocky in spots. A depth of 6½ fathoms has been found about 3¾ miles offshore and about 7½ miles eastward from Sledge Island. During heavy weather, tide rips, or breakers, have been observed about ¾ mile eastward from the northern point of the island; a depth of 5 fathoms is reported near this locality.

A depth of 3 fathoms, hard clay and bowlders, is reported 7 miles westward of Sledge Island and 4 miles from the beach just eastward of Cape Rodney. The 2¼ and 3 fathom shoals off the mouth of Sinuk River are said to exist about as charted.

From Cape Rodney to Cape Douglas the shore is a low sand beach, and the high land is farther inland from the beach than eastward of Cape Rodney. This coast is seldom approached close-to; the water is comparatively shallow, and dangerous shoals and ledges are found between Cape Douglas and Point Spencer. Vessels are cautioned to exercise care when approaching the shore while southward of Cape Douglas, and to give the shore between Cape Douglas and Point Spencer a berth of over 5 miles.

Currents.—A tidal current is perceptible from Cape Nome to Cape Rodney, but the strongest current sets northwestward; lying at anchor, vessels usually tail northwestward. In the vicinity of Sledge Island and between the island and the mainland the currents have considerable velocity; with strong southeast winds an average velocity of 2 miles and a maximum velocity of 3½ miles per hour have been observed setting northwestward. Vessels when in this vicinity should give special attention to the currents. Above Cape Rodney there is no perceptible current southward or eastward; the general set is northward and westward.

Off Nome City the tidal current is small, the average maximum being less than 0.2 knot. A northwest set of about 0.2 knot was found. West of Cape Nome the tidal current is less than 0.2 knot.

King Island is rugged and rocky, about 2 miles square, and 700 feet high. It has nearly perpendicular cliffs, deep water, and generally rocky bottom on all sides. There is a native village on the south side, the houses being built in the sides of the cliffs some distance above the water. Off the village, but close inshore, vessels may anchor in about 15 fathoms, muddy bottom, with good protection from northwest winds. In clear weather the island is an excellent

landfall for vessels coming from southward and bound to Port Clarence.

Cape York is a high, rocky, nearly vertical cliff, with numerous ravines, and a range of high, rugged mountains immediately back of it. The cliff is about 10 to 12 miles in extent. There is no distinct promontory, and no exact point along the cliff that can be defined as the cape. The water shoals slightly off the western end of the cliff, but nothing less than 6 fathoms will be found at a distance of 2½ miles from shore. A shoal with 2 fathoms is reported about 1½ miles southeastward of the cape.

A rock is reported about ¾ mile from the shore southeastward of York village.

Between Cape York and the high land of Cape Prince of Wales there is a bight, with comparatively low, rolling land back of it extending across the peninsula to the northern shore. The beach is low, and the water shoals gradually when approaching the shore. The eastern part of the bight is slightly shoaler than the western part; about 6 fathoms will be found 1 mile offshore; in the western part of the bight 8 fathoms will be found at the same distance from the beach. When standing westward alongshore, and when abreast of Cape Mountain, the water deepens suddenly to 20 fathoms.

PORT CLARENCE

is a good harbor, close to the strait, free from ocean swell, and is clear of ice about June 25 to 30. The bay is formed by a sand spit which extends from the mainland about 10 miles in a northerly direction to **Point Spencer.** The point is bold, with depths of 7 fathoms as close as ¼ mile.

The channel between Point Spencer and Point Jackson, on the north shore, is about 4 miles wide, clear of danger, and carries 7 to 9 fathoms. One and one-half miles south of Point Spencer a shoal makes into the bay from the sand spit, with depths of 2½ fathoms 1 mile off. The northern half of the bay has a general depth of 7 fathoms as close as 1 mile from the shore; the southern half of the bay shoals gradually from this depth toward the shore, and the extreme southern part is very shoal. The north shore is clear of danger and can be approached as close as ¼ mile, the soundings decreasing regularly to the beach.

Port Clarence connects at its northeast end with **Grantley Harbor,** which is 2 to 3 miles wide, about 8½ miles long, and connects at its eastern end by a narrow, difficult channel with **Imuruk Basin.** The mouth of the harbor is formed by two sand spits which slightly overlap; on the southern spit is the settlement of **Teller,** a post office and distributing point for supplies for this section. The water westward of the sand spits is shoal, but there is a channel close to the north one which can be used by vessels drawing 12 feet or less, but which should be sounded out before attempting to enter. Inside the harbor the depths range from 2½ to 3 fathoms, and it is probable that a draft of 12 feet can be taken through the channel to the basin. Vessels have gone into Grantley Harbor to heave down and repair on the north sand spit. **Bering** is a settlement on the eastern shore of Port Clarence about 5 miles south of Teller.

Fresh water can be obtained in several places in Port Clarence, the best being from a stream on the east side near Bering.

Anchorages.—There is anchorage in 5 fathoms, just inside Point Spencer; also in 5 fathoms 1½ miles off Teller, the village bearing 116° true (E ½ S mag.), exposed to southwest winds only.

Fog.—In this vicinity fog is quite prevalent and very dense in summer.

Tides.—The mean rise and fall in Port Clarence is 1 foot. Southwesterly winds increase and northeasterly winds decrease the height of tide.

Current.—Outside of Point Spencer the current sets northwestward with a velocity of 1 to 2 miles per hour.

DIRECTIONS, PORT CLARENCE.

In approaching Port Clarence in thick or misty weather the long, low spit of sand and shingle which forms the west side of the bay is not seen until close-to. The best course from southward is to steer directly for Cape York, bearing in mind the set of the current northwestward, and after making Cape York follow along the coast eastward until the entrance to Port Clarence is made out, then steer for the anchorage just inside Point Spencer. Or, follow the north shore at a distance of about 2 miles until abreast the settlement at Teller.

Dangers.—A ledge with a reported least depth of 1¾ fathoms lies nearly 5 miles offshore and about halfway between Cape Douglas and Point Spencer, and vessels should keep well outside of it. Extending about west-northwest from this ledge toward Cape York is a ridge with hard bottom and depths ranging from 4 fathoms near its southeastern end to 5 fathoms in about the latitude of Point Spencer. Spots with depths of 6 fathoms over them will be found 15 miles offshore westward of Cape Douglas. It is recommended that vessels approaching Port Clarence give the lowland between Cape Douglas and Point Spencer a berth of not less than 5 miles before hauling in for the entrance.

ARCTIC OCEAN.

The remarks on the navigation of Bering Sea (p. 225) apply generally to the Arctic Ocean as far as Point Barrow, except that the current and soundings in the Arctic are more uniform, and, with the exception of the shoals at Cape Prince of Wales, Hotham Inlet, Blossom Shoals, and Point Franklin, there are no outlying dangers, and the lead is an excellent guide in approaching the land. Another exception is that in the Arctic the question of ice must always be considered. The following remarks on the navigation, weather, and currents of the Arctic Ocean, by Capt. M. A. Healy, R. C. S., contained in the report of the cruise of the revenue steamer *Corwin* in the Arctic Ocean, 1884, though relating to an extreme season, may be of interest to those navigating these waters:

In my previous experience in the Arctic I have never seen a season like the past. From the time of first reaching the ice up to leaving the Arctic, dense fog has been almost constant. Currents that have hitherto been considered permanent in direction, if not in force, have become erratic, and others have entirely failed. The ice fell back before the sun's advance slowly and compactly. For three weeks after we reached the Diomede Islands it refused entrance into Kotzebue Sound, and three weeks later still it was hanging with discouraging tenacity around Point Hope. It was unsafe to anchor with any but a short scope, moving steam had to be kept, and constant vigilance exercised to prevent being dragged ashore by fields of ice moving in

the rapid and changing currents. For weeks at a time it was impossible to take observations, dead reckoning was almost worthless, owing to the continual changes in force and direction of the currents, and the safety of the ship depended entirely on the constant use of the lead. Fortunately for those who are obliged to sail this frozen ocean, the depth of water is not so great but what bottom can always be obtained, and the proximity of land is indicated by regular shoaling, with but few exceptions. Yet with this aid and the best charts that we have, several years' experience is necessary to enable the navigator to judge with any degree of precision the position of the ship. Anyone at all familiar with coasting knows how difficult it is to recognize land in a fog, where marks are well defined—high bluffs often appearing like low beaches and small rocks looming to gigantic size, while the general contour of the small portion of the shore visible may be taken for almost any land that one expects to make. How much more difficult must it be where the formation of the shore for miles differs but little, as is the case in the Arctic.

Among the best landmarks that we have in these northern waters are the bird rookeries at King Island, the Diomedes, Cape Seppings, Cape Thompson, and Cape Lisburne. The distance between these rookeries enables one to form a very accurate idea of the one he is approaching, while the cries of birds congregated at them answer the purpose of a fog signal. With one or two exceptions, these are the only aids to navigation.

In the shallow waters of this ocean the effect of the wind on the currents is very marked.

Inside the Arctic Circle snow has fallen all the past season, and it may almost be said that there has been no summer. As late as August 27 ice was within a few miles of Cape Sabine, and at the Seahorse Islands it was heavy and dangerous. The pack at this time was still southward of Point Barrow, and vessels could not go eastward of that place this season. During the latter part of our stay the weather was exceptionally severe.

The experience of many years in the Arctic has demonstrated the fact that no rules whatever can be given as to the time of the breaking up of the ice. The severity of the winter, the time at which spring weather opens, and the beginning of southerly winds that break up the ice all have their influence in governing this time. Vessels have been able to enter St. Michael as early as May 21; this year we found ice to the southward of St. Matthew Island on June 2, and some days later still in the season vessels have been stopped by it between the Seal Islands and Nunivak. The southern limit of the ice is almost entirely dependent on the severity of the winter. Heavy southerly winds and swell will break up the ice, and if followed by northerly winds it will open out and the waters become navigable. When once broken up, if the weather is mild, it will not cement again if nipping, and consequently will open more readily to light winds. Northeast winds tend to drive the ice off the American shore and westerly winds off the Siberian side. With these few exceptions, little can be said of ice conditions.

In clear weather the ice blink indicates the presence of ice, and it may be seen a great distance; but in thick, foggy weather approach to the pack must be made with great caution. Its proximity is usually indicated by the slack, and when this once begins to be seen about the vessel it may be judged that a large body is not far distant. As the pack is neared, one sees only ice as far as the eye can reach. It rises from 10 to 25 feet above the water. It is a well-known fact that the depth of water and the surrounding features of this ocean render the formation of large icebergs an impossibility.

When a pack is reached, it usually becomes necessary to track along its edge to find a lead. Whoever is piloting the ship takes his place at the masthead and with glass in hand seeks for a favorable opening. Oftentimes days are spent working up and down along the ice without clear water presenting itself, and when it does extreme caution must be used in entering the lead. It is here that the judgment and experience of the ice pilot becomes a necessity. The weather, currents, appearance of the ice, probable winds, and a dozen other things that would never enter the mind of a novice are to be taken into consideration before the vessel's head is turned into the pack. Once it is determined to enter the lead, vigilance must be doubled and every faculty kept on the alert. The vessel is conned from the masthead, and, while directing how the helm must be put to keep clear of immediate danger, the pilot must be looking ahead for the clearest water and watching ice, sea, and sky for change of currents and winds. If any signs of the closing-in of the lead are presented, the vessel must be gotten out as soon as possible, for, if shut in and she escapes being crushed, she will go to the northward in the drifting pack from 1 to 2 knots per hour, and it will become necessary to abandon her. If the lead followed up is between the ground ice and the pack and the wind comes on shore, a safe place can sometimes be found behind the ground ice. A vessel may be made fast to this ice with grapnels, or anchored

to leeward of it, and lay with comparative safety. If anchored in a current, however, with drifting ice about her, the scope of chain must be short and everything kept in readiness for getting under way at a moment's notice. If anchored in shoal water, it is desirable to get in the ice as far as possible to avoid the swell; but if the water is deep, the ice should be avoided. Generally the presence of the ice tends to kill the swell, and it will be found much smoother inside the ice than out.

The bowhead whale keeps as far to the northward as he can find spouting holes, and to take him the whalers are obliged to keep as close to the pack as possible. Usually they track along the Asiatic side in Bering Sea and Strait, and, as they reach the Arctic, cross over and work up the American shore to the northward and eastward. In Bering Sea there is very little danger in entering the ice, as it is almost sure to open and offer a chance to escape before reaching the Arctic. With a knowledge of this fact, whalers sometimes enter the ice to the southward of the strait and endeavor to work through it if they have reason to believe, from the sudden disappearance of the whale, that there is clear water to the northward. In the Arctic, however, the pack is carefully avoided, and it is only when conditions are most favorable that attempts are made to follow up the leads. Point Barrow is approached with the greatest caution, as it is one of the most dangerous places in the Arctic. As has already been mentioned, by far the major portion of the vessels lost in the Arctic are wrecked in its vicinity.

Ice.—Bering Strait is free of ice by the first week in July and sometimes earlier, but clear water does not extend very far northward, and it is seldom possible for vessels not fitted to encounter ice to reach Point Hope before July 10–15. Kotzebue Sound is usually open by July 15, at times a few days earlier, but it has been known to remain closed until the last of July. The running ice from Kotzebue Sound is encountered at Point Hope some time after the pack has moved northward. By July 15 the main pack has moved north of Cape Lisburne.

Thus far the movement of the ice does not appear to depend to such a great extent on the winds, it is reasonably certain each year, and dates can be depended upon within a small limit of time; but north of Cape Lisburne the movement is generally slow, uncertain, varying greatly in point of time in different years, and seems to depend almost wholly on the winds for its further movement. Prevailing northeasterly winds move it away from the shore rapidly and early, while southwesterly or westerly winds hold it against the shore and make a late season.

From Icy Cape north no specific time can be set for the opening of navigation. Its variations are from July 12 to the latter part of August, though an average date for the whaling vessels to reach Point Barrow is about August 1. Between these points and the early part of the season the ice is always dangerously near the shore, and southwesterly or westerly winds will bring it in. Later, the southern point of the pack is just off Seahorse Islands and generally remains there the rest of the season. From the Seahorse Islands to Point Barrow the pack is seldom far offshore, and from the latter point can almost always be seen. During the open season it is always liable to come in on these two points with a westerly wind.

Beyond Icy Cape there is always danger to vessels, and strangers should be cautious and careful in going there. In the lead of open water between the pack and the shore the current is swift and nearly always carries drift ice, and vessels rarely reach Point Barrow at any time without encountering some ice. The ice can not be forced, and vessels should not venture into small leads between the pack and shore ice. With a southwesterly or westerly wind, which brings the ice in, vessels seek protection east of Point Barrow when it is open, in Peard

Bay close in as possible, and under the lee of heavy ground ice, which acts as a breakwater against the smaller cakes. In anchoring where there is drifting ice, vessels should use a short scope and be ready to get under way immediately. A comparatively small cake will sometimes cause the loss of an anchor and chain. In the vicinity of Point Barrow sailing vessels should not go offshore in water too deep to anchor, as in light winds or calms the current is likely to take them into the pack. Navigation east of Point Barrow is such that it should only be attempted by those having experience.

As a rule, the pack does not come down on Point Barrow before the latter part of September, but in 1897 it came down the first of September, and, in general, except for whaling vessels, whose officers are men of long experience in judging the ice, weather, etc., September 1 is as late a date as vessels should remain in that vicinity. About this time, or a little later, young ice begins to make in the lagoons, along the shore, and around the old ice, though it is not likely to form in the open sea until the last of the month. The young ice makes stronger and spreads over the open sea with the advancing season. It is dangerous to vessels, and will very quickly cut through one not sheathed to withstand it. Ordinary vessels should be out of Kotzebue Sound by September 15 to 20, and out of the Arctic by October 1. The whaling vessels make it a rule to be ready to leave there about October 10, and though there may be times when they stay later, these are exceptions.

At times there is a body of ice, which holds on the Siberian shore through the summer, that moves down past East Cape into the western side of Bering Strait, sometimes as early as the latter part of August, and makes that side of the strait difficult of navigation late in the season.

Weather.—In summer the weather is usually light, with much fog and rain. The winds are variable, though mostly easterly and southerly. There are seldom gales in summer, but occasionally, sometimes with intervals of years, there come southwesterly gales, short-lived but very severe and disastrous, as there is little protection from winds in that quarter. In the vicinity of the ice the weather is nearly always light and foggy. Later in the season it grows more boisterous, gales are frequent and more generally from northward, and as the weather grows colder there is considerable snow.

Currents.—From Bering Strait to Point Barrow there is a general current setting northward alongshore (stronger inshore), which, when not affected by winds or stopped by the ice, has a velocity of not less than 1 mile at any part of it. The current from the strait turns northeastward and is joined north of Cape Krusenstern by that from Kotzebue Sound. From Eschscholtz Bay a northerly current sets alongshore on the eastern side of Kotzebue Sound, having a velocity of ½ to 1 mile at Cape Blossom. It continues past Cape Krusenstern, where it is increased by the flow from Hotham Inlet to a velocity of 1 to 2 miles, and northward of the cape joins the current from Bering Strait, where, in the latter part of July and August, its velocity is 1½ to 2 miles. It continues with the same velocity around Point Hope, then with a reduced velocity to Cape Lisburne and across to a short distance south of Point Lay. After rounding

Point Hope, and thence to Icy Cape, the current does not appear so strong, and, as a rule, is about 1 mile.

In the bight between Cape Lisburne and Cape Beaufort there is a tidal current, and unless, driven in by a westerly wind, the outside general current is not felt.

Northward of Point Lay, if the ice has not opened up from the shore, the current is stopped; but if the ice is open to Point Barrow the current continues along the shore and, because of the contracted space between the shore and the ice, increases in velocity to from 2 to 3 miles, and sometimes more, at Point Barrow.

This general current is more or less affected by the wind, and may be decreased or even stopped at times by northerly winds, but when the wind abates it starts again. When the wind is with the current its velocity is increased. Well offshore the currents are variable and not so strong, and depend to a great extent on the winds. There is, however, a general set northward.

Cape Prince of Wales is a peak, 2,300 feet high, comparatively regular in outline; on the south and southwest sides the slope of the mountain comes down to the sea. The face of the cape is a low sand beach, which extends northward 3 to 4 miles from the base of the mountain, and then trends northeastward toward Shishmaref Inlet. On this sand beach, close to the mountain, is the native village of **Kingegan** (Wales post office), the largest on the northern coast.

On approaching the cape from southwestward, nothing less than 20 fathoms can be had at a distance of ¾ mile from the highland at its southwestern extremity. From this point the 20-fathom line runs nearly northwest, gradually increasing its distance from shore until 5 miles northward, where it is 3 miles offshore. The 3-fathom line, commencing very close to the southwest point, increases, almost at once, its distance from the shore to 1 mile, continuing at that distance until the cape makes northeastward, where it joins, presumably, Cape Prince of Wales Shoal.

Cape Prince of Wales Shoal seems to be a ridge of sand, which extends about 8° true (N by W mag.) from the western extremity of the cape to a distance of about 25 miles. The depth of water on the shoal is not definitely known, but numerous cases are reported of whaling vessels having struck on it at distances supposed to be 10 or 15 miles from the cape. The western face of the shoal is very steep, the depth decreasing rapidly from 20 fathoms. It is recommended that vessels give this shoal a wide berth, and not haul eastward when coming from southward until at a distance of 25 to 30 miles from the cape. Vessels bound southward through the strait should be careful not to fall too far eastward and be caught between the shoal and the northern shore, especially sailing vessels with northerly or northeasterly winds.

Vessels making an **anchorage** off the native village of Kingegan at Cape Prince of Wales should approach it only from southwestward. The soundings decrease rapidly from 13 fathoms, and anchorage should not be made in less than 7 fathoms. During the open season the current sweeps by the cape northward with a velocity of 2 to 3 miles, and care should be taken in making an anchorage here not to be swept by this current upon the shoal.

Fairway Rock is a high, square-headed, steep-sided rock. The bottom is steep-to on all sides, and there are no outlying dangers.

Big and Little Diomede Islands rise abruptly from the sea, with nearly perpendicular sides; they are steep-to, and there are no beaches. The tops of the islands are a sort of broken table-land. The larger island is 1,759 feet high, the smaller somewhat lower. In their vicinity the water is deep with generally rocky bottom, and the anchorage is poor. There are some rocks above water close to shore on the west side of the larger one. The native village on the larger island is on the southwest side, off which vessels can anchor in 14 fathoms, sandy bottom. The channel between the islands is about 2 miles wide. It is not generally used, but whaling vessels have passed through, carrying 20 fathoms of water, favoring the side of the channel next the larger island. There is a native village on a rocky slope on the smaller island facing this channel, off which a reef of rocks and sand is said to extend a short distance into the channel.

East Cape is a bold, rugged headland, about 2,500 feet high, steep on all sides, and with deep water quite close-to. It has low, marshy land back of it, and when seen at a distance appears as an island. There are no dangers off the land, and except at the anchorages the water is deep with rocky bottom. There is good anchorage (in 8 fathoms) with good shelter from offshore winds, on both the north and south sides of the cape, where the low land back of it begins. There is also an anchorage (in 10 fathoms, muddy bottom) off the native village on the face of the cape.

From Cape Prince of Wales to Shishmaref Inlet the coast is a low sand beach, with lagoons and marshes back of it. On a clear day the mountains in the interior can be seen, the **Ears** and **Potato Mountain** (Cone Hill) being distinguishable.

Shishmaref Inlet, a large inlet extending into the land, has been explored by prospectors. Across its mouth is a low sand island, with shallow openings at each end. Shoal water extends off the mouth of the inlet several miles. It is reported that small craft can enter the inlet, and that there is a shelter for such behind the island at the entrance.

From Shishmaref Inlet to Cape Espenberg the coast is higher than that westward of the inlet, and is a line of low bluffs and small sand dunes, terminating at Cape Espenberg in a very low spit, which is made out with difficulty. A number of small native settlements are scattered along this coast from Cape Prince of Wales to Cape Espenberg.

KOTZEBUE SOUND

is about 30 miles wide at its entrance between Cape Espenberg and Cape Krusenstern, 22 miles from Cape Espenberg to the shoal water off the mouth of Hotham Inlet, and extends about 30 miles south of Cape Espenberg. Except for the shoal off the mouth of Hotham Inlet, the soundings throughout the sound are very uniform, varying from 7 to 9 fathoms. From Cape Espenberg the west shore of the sound is shallow some distance from the land, and vessels should approach it with care. The land on this side of the sound is generally low. There is a small but conspicuous hill about halfway between the cape and the southern shore. On the south side of the sound the land is higher, more rocky, and of a bolder character than

the west shore. Under water, also, it is bold, and has soundings of 4 and 5 fathoms quite close to the promontories.

Chamisso Island, at the entrance to Eschscholtz Bay, is a small, rounded island with a grassy hill 231 feet high. Its shores are rocky, except its northeast end, which is a low sand spit. Along its north and east sides shoals extend ¼ to ½ mile offshore.

Puffin Islet, west of Chamisso Island, is rocky, with two conspicuous rocks southward of it. Between the island and rocks and Chamisso Island the water is shoal and rocky. The water on the north and west sides of Puffin Islet is bold.

Chamisso Anchorage, between Chamisso Island and Choris Peninsula, is the only place on the Arctic coast of Alaska that can be called a harbor. By shifting anchorage ½ mile good shelter can be found from all winds. Off Choris Peninsula shoals extend toward Chamisso Island fully 1 mile. The deepest water is close to Puffin Islet. In approaching the anchorage give **Point Garnet**, the southwest extremity of Choris Peninsula, a berth of 1 mile, and stand down well toward Puffin Islet before hauling in. Anchor with Puffin Islet bearing 203° true (S mag.) at a distance not greater than ¾ mile, in 8 fathoms, muddy bottom.

Early in the season, **fresh water** can be obtained on Chamisso Island and on the east side of Choris Peninsula.

Tides.—The mean rise and fall at Chamisso Island is 4 feet.

Kiwalik River empties on the southern shore about 8 miles southward of Chamisso Island. It is reported that with local knowledge a depth of 12 feet at high water can be taken into the river to an anchorage behind the spit at the mouth. **Kiwalik** is a post office on the spit at the mouth of Kiwalik River.

Deering is a post office on the south side of Kotzebue Sound at the mouth of **Inmachuk River**, about 22 miles westward of Kiwalik.

Eschscholtz Bay, east of Chamisso Island and Choris Peninsula, is generally shoal. The soundings decrease gradually from Chamisso Anchorage to 2½ fathoms at 2 miles off the point which lies 4 miles west of Elephant Point. East of this point the shoaling continues, and this part of the bay is only navigable for small boats. The shore at the head of the bay is difficult of access on account of long, muddy flats, which, at low water are bare in some places ¼ mile from the beach. It is probable that the whole bay is gradually filling up, and vessels going east of Chamisso Anchorage should proceed with caution. **Buckland River**, a large but shallow river, empties into the head of the bay. There are few natives in its vicinity.

Choris Peninsula, forming the western side of Eschscholtz Bay, has two hills, about 300 feet high, separated by a low, sandy neck. Northward of Choris Peninsula the land is low for some distance, and then rises into low bluffs which continue to Hotham Inlet. These bluffs are composed of ice and frozen mud, which is gradually melting and sliding down, making deep furrows all along their face.

Cape Blossom is a distinctly marked point in this line of bluffs, which are highest at the cape and slope to either side.

The bottom of this side of the sound is very even southward of Cape Blossom at a distance of about 5 miles from the land; but northward of the cape a shoal, with very little water on it, extends 8 to 10 miles off the land from the mouth of Hotham Inlet, and south to within 2 miles of the latitude of Cape Blossom. This shoal is very dangerous,

as the soundings give short warning of its proximity, the distance from the shore can not be judged under ordinary conditions, and there are no good landmarks.

The general **anchorage** in this vicinity is off Cape Blossom, as it is the nearest point from which communication can be had with Hotham Inlet. In approaching the cape, it should not be brought to bear eastward of 90° true (ENE mag.) until in the vicinity of the anchorage. Anchor in 5 fathoms with the cape bearing between 90° true (ENE mag.) and 102° true (E by N mag.) distant 3 miles. This anchorage is protected from northerly and easterly winds. There is generally a current, strongest in the early part of the season, with a velocity of ½ to 1 mile, setting northwestward.

The coast from Cape Blossom to the mouth of Hotham Inlet is the place of rendezvous for the natives of the surrounding country for the purpose of fishing and trading. The coast natives from Cape Prince of Wales, including the Diomedes and King Island, to Point Hope, assemble here about the last of July to meet those who come down the large rivers from the interior.

HOTHAM INLET

is about 35 miles in length and 4 to 8 miles in width. Its general trend is southeast; its water is little influenced by tides, but a prolonged southeast wind causes a low stage. The entrance is obstructed by vast mud flats and sand bars, some of which are bare at low water. There is a shifting channel, which is difficult to trace, running close along the shore from Cape Blossom north to the inlet, through which 4 to 5 feet can be carried. This channel could not be found in 1898. A channel with a depth of 8 feet on the bar at high water was used in 1898, but it is difficult to find without a pilot. The entrance to this channel was about 10 miles from the Cape Blossom shore and well northward of the cape. Winds from southward and westward raise the water on the bar and from northward and eastward lower it. In the inlet proper the channel in 1884 had a depth of 3 to 7 fathoms for a distance of 20 miles. There are three large rivers emptying into the inlet. No landing can be made at many places in the inlet on account of extensive mud flats.

The **Noatak River**, joining it at the north, has numerous rapids, and is not navigable for any distance for boats larger than native canoes. The natives portage from the headwaters of this river to the Chipp River, and thus to the Arctic Ocean east of Point Barrow. There is a cannery at the mouth of the river.

The **Kobuk River** empties at the east side of the inlet by many mouths, off which shoals with 2 to 4 feet extend far out into the inlet. In crossing the bar, which is indicated by drift lodged on the shoals, it is difficult to find a channel, the one generally used being known as the "Middle Mouth." The delta from the inlet is about 45 miles long and very difficult to navigate, but when fairly between the banks of the river there is comparatively deep water. In 1898 a large number of prospectors were attracted to the region of Hotham Inlet. Two stern-wheel steamers were used in transporting their supplies up the Kobuk River, and it is said that these steamers ascended the river 200 miles. The current in the river was found very strong, running at some points with a velocity of

5 or 6 miles an hour. The current is dangerous for small boats; eight men lost their lives in 1898 while boating their provisions up the river. The natives portage from the headwaters of the Kowak River to the Koyukuk River, a branch of the Yukon.

Selawik Lake is the prolongation of the head of Hotham Inlet eastward; it is about 50 miles long and 20 miles wide, and a depth of 2 fathoms can be taken around the lake by giving the shores a good berth. It has a large river, Selawik River, emptying into it at its head, the entrance of which is obstructed by a mud flat extending ¾ mile from the shore, through which a depth of 12 feet could be carried, in 1884, into the westernmost outlet of the river into the lake.

KOTZEBUE SOUND TO POINT BARROW.

From Hotham Inlet to Cape Krusenstern the coast is a low beach. The shoal water from the mouth of the inlet extends nearly halfway to the cape; the edge of the shoal is steep, and should be approached carefully. From where the shoal joins the land to Cape Krusenstern there is good water close in, with regular soundings.

Cape Krusenstern.—Back of Cape Krusenstern there is a high, prominent range of mountains, which can be seen at a long distance. On nearer approach the mountains are seen to fall away to the cape in a series of steps, and in shaping a course into the sound these cliffs, or steps, must not be mistaken for the cape, which is a low point extending about 3 miles westward of them. A shoal extends about 2 miles westward and northward off the point of the cape.

From Cape Krusenstern to Cape Seppings the coast is a low, shingly beach, back of which is a series of lagoons, which discharge their waters through small, shallow openings. The high land of Cape Krusenstern extends along this coast some distance inland, terminating in the Mulgrave Hills, about 30 miles northwestward. After passing Mulgrave Hills the land is an extensive plain until in the vicinity of **Cape Seppings.** Here the mountains approach close to the coast and slope down to the water. Cape Seppings and Cape Thompson are not distinct, and it is difficult to determine the points to which the names should be applied.

In the vicinity of **Cape Thompson,** for a distance of 6 miles, the mountains break off directly to the water in a series of abrupt cliffs about 500 feet high. The coast is generally straight, and there are no distinct promontories. What was probably named Cape Thompson is a rugged mountain face, about in the middle of this line of cliffs, having at its southern end a distinct series of strata in the form of an irregular semicircle. In the ravine south of this point there is a small stream, from which good water can easily be obtained. Directly off the watering place anchorage may be had in 5 fathoms, sandy bottom. At other points along the cliffs the bottom is generally rocky.

From Cape Thompson the mountains continue northward to Cape Lisburne, while the coast curves northwestward and westward to Point Hope.

Point Hope is the western extremity of a low tongue of land which projects almost 16 miles from the general line of the coast mountain range. It has a steep shingle beach, and its surface is broken by a number of lagoons. The largest of these, **Marryat Inlet,** has its

entrance on the north side, close to where the coast trends northward, and a draft of 10 feet can be carried through the entrance. For a number of years some small schooners have been using this inlet as a place to winter. Those not familiar should sound out the channel before entering. In the first of the season, when the ice breaks in the inlet, there is a strong current running out and the moving ice is more or less dangerous. There is a large native village called **Tigara** on the end of Point Hope, and scattered on the south side, from the end of the point to Cape Thompson, are a number of whaling stations conducted by white men, which are maintained throughout the year.

In the bight just west of the high land of Cape Thompson the water is somewhat shoaler than farther west, though the soundings are regular. Seven miles east of Point Hope there is a 3-fathom shoal nearly 1 mile offshore. As the point is approached the water deepens, and toward its end 8 fathoms can be carried to within ¼ mile of the beach. The tip of the point is very bold, there being 13 fathoms a few ship's lengths from shore; but on rounding the point to the north side the soundings decrease rapidly to 5 fathoms ½ mile from shore, and, in general, the water in the bight on the north side of the point is shoaler than on the south side. At the mouth of Marryat Inlet shoals extend off some distance.

There is a narrow shoal, with a depth of 4 fathoms at its southern end, which lies about 2¼ miles 314° true (WNW mag.) from Point Hope. This shoal extends in a general 314° true (WNW mag.) direction for a distance of 3 miles from the 4-fathom spot, and has depths of 5 to 7 fathoms over it.

From the mouth of Marryat Inlet to Cape Lisburne the mountains lie along the coast and terminate at the shore in rugged, rocky cliffs. There are a few ravines through the cliffs, having running streams, with beaches at the shore, where fresh water can be obtained.

Cape Lisburne is a bare, brown mountain, 850 feet high, forming a rugged headland that is distinctly marked by the number of pinnacles and scattered rocks near its summit. Its faces at the shore are very steep. At the cape the coast changes its direction abruptly eastward. There are no outlying rocks, but there is a ridge extending 5 miles northeastward from the cape, on which 5 fathoms can be found at a distance of 2 to 3 miles from the land. Off this cape the wind rushes down from the mountains in gusts of great violence and varying directions, and with offshore winds vessels should keep well off the land in passing.

From **Cape Lisburne to Cape Sabine** the land is lower and loses the rugged character of that southward of the former cape. The hills are rounded and rolling, regular in outline, and slope to the sea. Toward Cape Sabine the land becomes a series of ridges and valleys running inland; both terminate at the coast in bluffs.

Cape Sabine is the end of one of these ridges, and projects but slightly from the general line of coast.

Coal.—Veins of coal are found from Cape Thompson to Cape Beaufort. In the face of the bluffs at Cape Sabine some veins, varying in thickness from 1 to 4 feet, have been worked by whaling vessels. The veins show plainly along the top of the bluffs directly at the shore. The use of the coal is limited, owing to its poor quality and the difficulties in obtaining it, and it is not recommended to depend upon it except in case of necessity.

From Cape Sabine to **Cape Beaufort** the land continues of a rolling character until nearing the latter cape, which is a dark mountain coming down directly to the coast. There is no break in the coast at the cape, and it probably received its name as such because seen at a distance. This is the most northern extension of high land on the coast of Alaska. The mountains at this point trend inland and the coast continues low.

The bight from Cape Lisburne to Cape Beaufort is comparatively shallow, but the bottom is regular, and anchorage may be had anywhere alongshore from 1 to 2 miles from land. Directly off Cape Beaufort the water is shoaler than elsewhere between it and Cape Lisburne. There are numerous valleys along this part of the coast, nearly all of which have streams of good water. North of Cape Beaufort it is almost impossible to obtain fresh water on the coast.

About 10 miles north of Cape Beaufort is the southern end of a large lagoon, which stretches along the coast without a break to within a few miles of Wainwright Inlet. Separating this lagoon from the ocean is a narrow strip of sand beach, elevated but a few feet above the water, with several small, shallow openings through it south of Icy Cape, and two considerable openings north of that cape. The land on the inside of the lagoon is generally low, but in coasting along, some small bluffs, with low, rolling land back of them, can be seen in places. South of Icy Cape the lagoon has three large rivers emptying into it, and its whole extent is filled with flats and bars that make it scarcely navigable even for native canoes. North of Icy Cape the water in the lagoon is deeper. Through an opening about 10 to 12 miles from the cape 8 feet of water can be safely carried, with 2 to 3 fathoms inside. The channel is close to the sand spit on the south side of the entrance.

Another opening, 10 to 12 miles farther north, is somewhat shallower.

Point Lay and **Icy Cape** are merely bends in the sand spit forming the coast. Both places can be distinguished by some hummocks on the beach. A wooden beacon, 20 feet high, was erected on Icy Cape to mark the beginning of Blossom Shoals.

From Cape Beaufort to Icy Cape the bottom is regular, and the shore can be approached closer than in that part of the bight west of the former cape. When coasting, it should be remembered that off the openings into the lagoon the water is shoaler than on either side.

Blossom Shoals extend 6 to 8 miles off Icy Cape, and are a number of ridges parallel with the coast. These shoals are greater in extent than shown on any chart, and, from the grounding of vessels and observation, appear to be spreading. In approaching the shoals the bottom is lumpy and the soundings irregular. Of late years, on account of frequent grounding in unexpected places about the edge of the shoals, all the whaling vessels give them a wide berth; and it is recommended that vessels rounding Icy Cape should keep outside of 12 fathoms.

Wainwright Inlet, about 40 miles from Icy Cape, is a moderate-sized lagoon, and has a river emptying at its head. Its entrance, between **Point Marsh** and **Point Collie**, is a narrow, difficult channel, through which 8 to 10 feet can be carried. Inside the water is deeper. Off the mouth of the inlet the water is shoal fully 1 mile from land.

The coast from Point Collie to Point Belcher is a continuous line of mud cliffs until within a few miles of the latter point.

At Point Belcher the coast again becomes a shingle beach, with lagoons inside, and back of it low, rolling hills, which are higher than any other land that can be seen north of Cape Beaufort. North of the point the coast continues in a very low sand beach to Seahorse Islands.

Seahorse Islands and **Point Franklin** are the highest points of a continuous sand bank which extends from a point 8 miles north of Point Belcher to Point Franklin, thence turning abruptly east to the mainland at Peard Bay incloses a large lagoon. The first two islands from Point Belcher are higher than the rest of the bank, and their position seems to be permanent. The openings between the islands are, as a rule, very shallow and continually changing. Former openings are now closed, and openings now occur in the positions of former banks. Point Franklin is a very small sand island, with several hummocks on it. It is so small and far removed from the other islands that it is not easily made out. The greatest changes in the bank occur in that part of it between Point Franklin and Peard Bay, of which what is above water is merely a narrow strip of sand.

In the vicinity of Seahorse Islands the water is shoal, especially off the openings and Point Franklin. Off Point Franklin a shoal makes out several miles northward and northeastward, and vessels rounding the point should give it a berth of 4 to 5 miles.

Peard Bay, eastward of Point Franklin, is a deep bight which is often used by whalers in heavy southerly and southwest winds, and for protection from ice when it sets toward the shore. The bottom of the bay is regular, and the soundings decrease gradually to the shore. The water is deeper along the mainland than on the south side along the sand spit making out to Point Franklin.

The **coast from Peard Bay to Cape Smyth** is a line of mud cliffs 25 to 70 feet high, being highest at what is called **Skull Cliff.** From this point they become gradually lower to Cape Smyth, where they end. The coast curves regularly northward, and there are no projecting points. The cliffs are broken by numerous small rivers. There are beaches at the mouths of the rivers, but little or none along the face of the cliffs.

Cape Smyth is not a projecting point, and can not be distinguished as a cape. There is a large native village at the end of the mud cliffs at this point. The United States signal station and refuge station, formerly here, are not now maintained, but there is a whaling station conducted by white men.

From Cape Smyth to Elson Bay the coast is low with a grassy plain back of it; but from the head of Elson Bay to Point Barrow the coast is a narrow sand spit.

Offshore from Refuge Inlet to the head of Elson Bay the water is deep, and soundings of 15 fathoms are found about 2 miles from the land. The water then shoals evenly to 7 fathoms at about 1 mile from shore. The depths then lessen rapidly to 2½ to 3 fathoms about ¾ mile offshore, where there is a slight ridge shoved up by the ice, and which in the early part of the season is always marked by heavy ground ice. Inside and close to this ridge the water deepens again to 3 to 4 fathoms, and vessels seek this inside passage for protection from the ice when necessary. The ridge ends in a 2½-fathom

shoal about 1½ miles offshore where the high land ends and the sand spit begins at the head of Elson Bay. From this point to Point Barrow, depths of 3½ to 4 fathoms can be carried very close up to the sand spit, and there is apparently no ridge in the bottom as in that southward.

At **Point Barrow**, latitude 71° 23′ 31″ N, longitude 156° 21′ 30″ W, the most northern point of Alaska, the sand spit forming the coast turns abruptly eastward. There is a native village on the end of the point. Directly off the point the water is fairly bold, and 3 fathoms can be carried to within ¼ mile of the shore. Farther offshore the deepest water of this part of the Arctic Ocean is found. On rounding the point eastward the water becomes shoal, and the coast can seldom be approached anywhere closer than 2 miles. About 2 miles east of Point Barrow is **Moore Channel**, the entrance to **Elson Bay**, where H. M. S. *Plover* wintered in 1852–53–54. A shoal with a least depth of 2 fathoms makes off from the point on the east side of the channel, and extends westward, from ½ to ¾ mile off the sand spit, and ends nearly opposite the native village on Point Barrow. Inside the shoal there is a channel leading to Moore Channel, with nothing less than 3 fathoms, and deeper water in Moore Channel. This channel is often used as an anchorage for protection from the ice, as heavy ice grounds on the outer shoal. Changes may be expected in the channel at the entrance.

Tides.—The mean rise and fall at Point Barrow is 0.4 foot.

COAST EASTWARD OF POINT BARROW.

A shoal, with a depth of 3½ fathoms, is reported to lie about 6 miles northeastward from Point Barrow.

Ice.—The ice pack seldom moves more than a few miles offshore between Icy Cape and Point Barrow, and is likely to close in at any time. A northeast wind, although it blows directly along the shore, keeps the ice clear and allows the current to set up past Point Barrow. The heavy ice, when close inshore, stops the surface current entirely and lowers the temperature to about 36° F. or less, so that a vessel working up the shore may readily tell if the ice is on the point by watching the set of the current and the temperature of the water. If the ice is clear of the shore the current will be setting northward from 1 knot to 3 knots per hour, with a temperature of about 40° F.

A vessel going northward of Icy Cape should sight the ice pack frequently, keeping close watch of its movements, and in the event of its starting inshore should get below Blossom Shoals as soon as possible, as several vessels have been caught in the ice in the vicinity of Point Barrow, and some probably crushed.

Eastward of Point Barrow it is reported that ice is always found along the coast, the heavier ice being in close proximity to the various projecting points and islands. With westerly or northwesterly winds the ice pack is likely to come down upon the shores at any or all of these points, while a northeasterly wind may be expected to clear the ice from the coast and open a lane.

Tangent Point is low, flat, and indented by a number of shallow lagoons.

Cape Halkett lies about 55 miles eastward of Tangent Point. **Pacific Shoal**, about 1 mile in extent and having about 15 feet of water, is reported about 7 miles eastward of Cape Halkett.

Colville River enters the ocean 40 miles eastward of Cape Halkett. The delta at the mouth of the river is called **Beechey Point.**

Jones Islands, also called **Thetis Islands**, extend from the delta of Colville River eastward a distance of 25 miles to Return Reef. The group consists of a considerable number of small islands, the largest reported to be about 3 miles in length.

Return Reef was the most westerly point reached by Franklin in his exploration of the coast in 1826.

Midway Islands, about 15 miles eastward of Return Reef, form the western extremity of a chain of islets and shoals known as **Lion Reef**, which extends eastward, roughly parallel to the coast, a distance of 50 miles to **Flaxman Island.** The islands lie, in general, from 4 to 7 miles offshore. Separating the islands from the mainland is a channel, reported to have a least depth of 18 feet in the middle, which has been used by whalers compelled to seek refuge from the ice. Vessels enter past **Pole Island**, about midway of the group, steering for a small inshore group of islands shown on the chart until in mid-channel. They then follow the mainland, coming out in the vicinity of Return Reef. The entrance channel is said to be marked by a pole on the island.

A shoal area is reported to exist about 25 miles northward of Flaxman Island, but no definite information concerning it is available.

Simpson Cove lies 20 miles east-southeastward of Flaxman Island. The cove, although restricted, is said to afford good anchorage, available for winter quarters, southward of **Collinson Point.** A sand spit affords protection from northerly winds and from ice.

During the summer the Eskimos come down from the interior for trading purposes, and at that season their camps may be expected at Collinson Point and Barter Island. During the winter the region is uninhabited.

Barter Island lies about 45 miles east-northeastward of Flaxman Island. From Barter Island eastward to **Herschel Island** the coast, although still low, has deeper water than that to the westward. East of Barter Island the 10-fathom curve is a good depth to follow, while west of the island the depth usually carried is about 7 fathoms.

Demarcation Point is the northern extremity of the boundary between Alaska and Canada.

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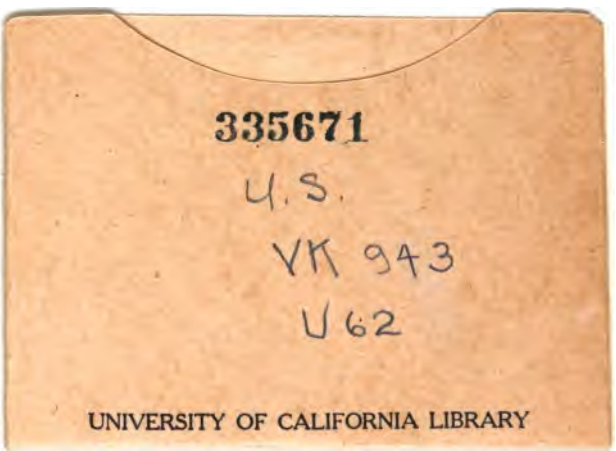

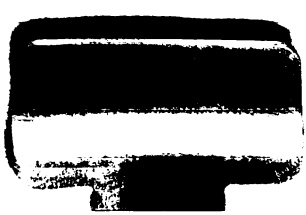

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